LOCATION ADJUNTAS PR

Established Series
Rev. RER
06/2002

ADJUNTAS SERIES

The Adjuntas series consists of deep, well drained, moderately permeable soils on uplands. They formed in clayey residuum weathered form volcanic rock. Slopes range from 40 to 60 percent. Mean annual precipitation is 85 inches and the mean annual temperature is 76 degrees F.

TAXONOMIC CLASS: Very-fine, kaolinitic, isohyperthermic Inceptic Hapludox

TYPICAL PEDON: Adjuntas clay in a native pasture.
(Colors are for moist soil.)

Ap--0 to 5 inches; dark brown (10YR 3/3) clay; moderate fine and medium granular structure; firm, slightly sticky, plastic; many fine roots; 3 percent volcanic fragments 1/4 to 1 inch in diameter; few fine quartz grains; many pores; very strongly acid; clear smooth boundary. (4 to 6 inches thick)

Bw1--5 to 10 inches; dark brown (7.5YR 4/4) and strong brown (7.5YR 5/6) clay; weak fine subangular blocky structure; firm, slightly sticky, plastic; common fine roots; few patchy clay films; 3 percent volcanic fragments 1/4 to 1 inch in diameter; few fine quartz grains; many fine pores; very strongly acid; clear smooth boundary. (4 to 7 inches thick)

Bw2--10 to 17 inches; strong brown (7.5YR 5/6) clay; weak fine and medium subangular blocky structure; firm, slightly sticky, plastic; few fine roots; common patchy clay films; 3 percent volcanic fragments 1/4 to 1 inch in diameter; few fine quartz grains; many fine pores; very strongly acid; clear wavy boundary. (6 to 9 inches thick)

Bw3--17 to 24 inches; yellow (10YR 7/6), white (10YR 8/2), and brownish yellow (10YR 6/8) clay with common fine

prominent red mottles; weak medium subangular blocky structure; friable, slightly sticky, plastic; few fine roots; many fine pores; many quartz grains; very strongly acid; clear wavy boundary. (6 to 10 inches thick)

CR--24 to 48 inches; strongly and partially weathered volcanic rock.

R--48 inches; semi-consolidated volcanic rock.

TYPE LOCATION: Sur SCD, Puerto Rico; 320 meters east of school at dead end of Highway No. 602.

RANGE IN CHARACTERISTICS: Thickness of the solum and depth to the CR horizon is 20 to 40 inches. Depth to R horizon is 40 to 60 inches. Reaction ranges from strongly to extremely acid. Fine or medium rock fragments in the solum varies from 2 to 5 percent. Quartz grains in the solum ranges from few to many. Base saturation is less than 50 percent in the cambic horizon.

The A horizon has hue of 10YR, values of 3 or 4, and chroma of 2 to 4. Structure is fine or medium granular.

The Bw horizon has hues of 10YR or 7.5YR, values of 4 or 5, and chroma of 4 to 8. Structure is weak, fine or medium subangular blocky. The lower Bw horizon has yellow, white, and brownish yellow colors and prominent red mottles.

COMPETING SERIES: There are no other known series in the same family.

GEOGRAPHIC SETTING: The Adjuntas soils are very steep soils on side slopes and narrow ridges at elevations below 550 meters. Slope gradients range from 40 to 60 percent. The soil formed in clayey residuum weathered from volcanic rock. The climate is humid tropical. The average annual precipitation ranges from 80 to 90 inches, and the mean annual temperature is 76 degrees F.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Consejo, Consumo, Daguey, Humatas, and Maraquez series. The Consumo, Daguey, and Humatas soils, are redder throughout, and deeper to the volcanic rock, and have argillic horizons. The Maraquez soils occupy similar positions and are less acid and have loamy B horizons. The Consejo soils are deeper, yellower, and have argillic horizons.

DRAINAGE AND PERMEABILITY: Well drained; very rapid runoff; moderate permeability.

USE AND VEGETATION: Mostly in native pasture and brush.

DISTRIBUTION AND EXTENT: Humid uplands of Puerto Rico. The series is of minor extent, with about 2,200 acres.

MLRA OFFICE RESPONSIBLE: Auburn, Alabama

SERIES ESTABLISHED: Ponce Survey Area, Puerto Rico; 1971.

REMARKS: Diagnostic horizons and features recognized in this pedon are:

Ochric epipedon - 0 to 5 inches (Ap)

Cambic horizon - 5 to 24 inches (Bw1, Bw2, Bw3,)

Paralithic contact - 24 inches (CR)

Lithic contact - 48 inches (R)

ADDITIONAL DATA: Characterization data - S73PR-01-1. Sample numbers 74B174-74B179.

National Cooperative Soil Survey
U.S.A.

LOCATION AGUILITA PR

Established Series
Rev. JLL:GRB
7/98

AGUILITA SERIES

The Aguilita series consists of deep, well drained, moderately permeable soils on ridgetops, summits, and side slopes in uplands of the limestone hills and mountains of the Semiarid Mountains and Valley MLRA. They formed in material weathered from soft limestone bedrock. Near the type location, the mean annual precipitation is about 35 inches, and the mean annual temperature is about 79 degrees F. Slopes range from 2 to 60 percent.

TAXONOMIC CLASS: Coarse-loamy, carbonatic, isohyperthermic Aridic Calciustolls

TYPICAL PEDON: Aguilita very gravelly clay loam - in pastureland. (Colors are for moist soil unless otherwise indicated.)

Ap--0 to 8 inches; very dark brown (10YR 2/2) gravelly clay, very dark grayish brown (10YR 3/2) dry; moderate medium granular structure; firm, slightly sticky, slightly plastic; many very fine, fine, and medium roots; many very fine and fine interstitial pores; about 25 percent, by volume, pebbles; moderately alkaline; strongly effervescent; clear smooth boundary. (3 to 8 inches thick).

Bk--8 to 14 inches; dark brown (10YR 4/3) clay, brown (10YR 5/3) dry; weak medium subangular blocky structure; firm; sticky, plastic; many very fine and fine roots; many very fine and fine tubular and vesicular pores; many prominent nodules and soft masses of calcium carbonate; moderately alkaline; strongly effervescent; clear smooth boundary. (3 to 6 inches thick).

C1--14 to 21 inches; very pale brown (10YR 8/3) clay loam, white (10YR 8/2) dry; massive; friable; slightly sticky, slightly plastic; many very fine, common fine roots; many very fine, common fine tubular and vesicular pores; many

prominent soft masses of calcium carbonate; moderately alkaline; strongly effervescent; clear smooth boundary.

C2--21 to 33 inches; very pale brown (10YR 8/3) clay loam, white (10YR 8/2) dry; massive; friable; slightly sticky, slightly plastic; common very fine and fine roots; many very fine, common fine tubular and vesicular pores; many prominent soft masses of calcium carbonate; moderately alkaline; strongly effervescent; gradual smooth boundary.

C3--33 to 43 inches; pale brown (10YR 6/3) clay loam, light gray (10YR 7/2) dry; massive; friable; slightly sticky, slightly plastic; common very fine and fine roots; many very fine, common fine tubular and vesicular pores; many prominent soft masses of calcium carbonate; moderately alkaline; strongly effervescent; gradual smooth boundary.

C4--43 to 54 inches; light olive brown (2.5Y 5/3) loam, light yellowish brown (2.5Y 6/3) dry; massive; friable; slightly sticky, slightly plastic; many very fine, common fine roots; many very fine tubular and vesicular pores; many prominent soft masses of calcium carbonate; moderately alkaline; strongly effervescent; clear smooth boundary.

Cr--54 to 80 inches; 50 percent light olive brown (2.5Y 5/3) and 50 percent very pale brown (10YR 8/3) stratified soft limestone bedrock, 50 percent light yellowish brown (2.5Y 6/3) and 50 percent very pale brown (10YR 8/3) dry; moderate medium and thick platy rock structure; few fine roots in fractures; stratified layers 8 to 12 inches thick; moderately alkalline; strongly effervescent.

TYPE LOCATION: Cabo Rojo Municipio, Puerto Rico. Approximately 3.7 miles northeast of El Combate; southeast from the intersection of P.R. Hwy. 301 and P.R. Hwy. 303, about 0.1 mile south on P.R. Hwy 303, about 200 feet east of highway; USGS Cabo Rojo topographic quadrangle; lat. 17 degrees 59 minutes 24 seconds N. and long. 67 degrees 9 minutes 21 seconds W.; PRD 1940.

RANGE IN CHARACTERISTICS: Depth to soft limestone bedrock ranges from 40 to 60 inches. Reaction is moderately alkaline throughout. Rock fragments include pebbles and cobbles composed of limestone.

The A or Ap horizon has hue of 10YR, value of 2 or 3, and chroma of 2 or 3. Texture is loam, clay loam, or clay in the fine-earth fraction. Content of rock fragments range from 5 to 60 percent, by volume.

The Bk horizon has hue of 7.5YR to 2.5Y, value of 3 to 8, and chroma of 1 to 6. Texture is loam, silt loam, silty clay,

clay loam, or clay in the fine-earth fraction. Nodules and soft masses of calcium carbonate concretions and other features such as filaments of calcium carbonate range from common to many. Content of rock fragments range from 0 to 25 percent, by volume.

The BCk horizon, where present, has hue of 7.5YR to 2.5Y, value of 4 to 8, and chroma of 4 or 6. Textures are similar to the Bk horizon. Nodules and soft masses of calcium carbonate concretions and other features such as filaments of calcium carbonate range from common to many. Content of rock fragments range from 0 to 25 percent, by volume.

The C horizon has hue of 7.5YR to 2.5Y, value of 6 to 8, and chroma of 1 to 6. Texture is loam, silt loam, or clay loam in the fine-earth fraction. Content of rock fragments range from 0 to 15 percent, by volume.

The Cr horizon is composed of soft limestone bedrock. It has hue of 7.5YR to 2.5Y, value of 6 to 8, and chroma of 1 to 6. It can be excavated with difficulty with hand tools, and is rippable by mechanized equipment.

COMPETING SERIES: There are no competing series in the same family.

GEOGRAPHIC SETTING: Aguilita soils are on ridgetops, summits, and side slopes in uplands and limestone hills and mountains of the Semiarid Mountains and Valleys MLRA. They formed in material weathered from soft limestone bedrock. Slopes range from 2 to 60 percent. The climate is tropical semiarid. The average annual temperature ranges from 78 to 80 degrees F., and the average annual precipitation ranges from 30 to 40 inches.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Duey, San German, Tuque, and Yauco soils. Duey and San German soils are on similar positions, but are shallow to soft limestone bedrock. In addition, San German soils do not have a Mollic epipedon. Tuque soils are on similar positions and have a petrocalcic horizon. Yauco soils are on lower positions, and are moderately deep to soft limestone bedrock.

DRAINAGE AND PERMEABILITY: Well drained; moderate permeability.

USE AND VEGETATION: Most of the acreage is used for pastureland. Vegetation consists of Mesquite, Huracan, and other xerophytic grasses and shrubs.

DISTRIBUTION AND EXTENT: Uplands of the Semiarid Mountains and Valleys of southern Puerto Rico. The series is of small extent.

MLRA OFFICE RESPONSIBLE: Auburn, Alabama

SERIES ESTABLISHED: Puerto Rico; 1936.

REMARKS:

The Aguilita soils were correlated as Loamy-skeletal, carbonatic, isohyperthermic Typic Rendolls in the 1970 Soil Survey of the Virgin Islands of the United States. The change from Typic Rendolls to Typic Calciustolls took place when Soil Taxonomy did not allow Rendolls to have an Ustic Soil Moisture Regime.

The type location was moved to Puerto Rico from the U.S. Virgin Islands in 1998 and the series reclassified based on soil lab data and observations in the field.

Diagnostic horizons and features recognized in this pedon are:

Mollic epipedon - zone from 0 to 8 inches (Ap horizon)

Calcic horizon - zone from 8 to 14 inches (Bk horizon)

ADDITIONAL DATA: Characterization pedon - Cabo Rojo Municipio, Puerto Rico; S97PR-023-002. Sample by the NSSL, Lincoln NE., 6/97.

MLRA: 271.

National Cooperative Soil Survey
U.S.A.

LOCATION ALONSO PR

Established Series
Rev. BCD
07/2001

ALONSO SERIES

The Alonso series consists of very deep, well drained, moderately permeable soils on sideslopes in maturely dissected uplands. They formed in fine textured residuum weathered from basic volcanic rock. Slopes range from 12 to 60 percent. The mean annual precipitation is about 92 inches and the mean annual temperature is about 73 degrees F.

TAXONOMIC CLASS: Very-fine, parasesquic, isohyperthermic Oxic Dystrudepts

TYPICAL PEDON: Alonso clay--coffee plantation. (Colors are for moist soil.)

Ap--0 to 6 inches; dark reddish brown (5YR 3/3) clay; weak medium subangular blocky structure parting to granular; firm, slightly sticky, plastic; many fine roots; very strongly acid; clear smooth boundary. (5 to 7 inches thick)

Bt1--6 to 16 inches; dusky red (10YR 3/2) clay; moderate medium subangular blocky structure; firm, slightly sticky, plastic; many fine roots; few faint clay films; very strongly acid; clear wavy boundary. (7 to 12 inches thick)

Bt2--16 to 25 inches; dark reddish brown (2.5YR 3/4) clay; moderate fine and medium subangular blocky structure; firm, slightly sticky, plastic, common fine roots; many faint clay films; very strongly acid; clear wavy boundary. (7 to 12 inches thick)

Bt3--25 to 32 inches; dark reddish brown (2.5YR 3/4) clay; moderate fine subangular blocky structure; firm, slightly sticky, plastic; few fine roots; few faint clay films; very strongly acid; clear wavy boundary. (6 to 9 inches thick)

Bt4--32 to 47 inches; dark reddish brown (5YR 3/3) clay with common, medium distinct dark red (2.5YR 3/6) mottles;

weak fine and medium subangular blocky structure; firm, slightly sticky, plastic; few fine roots; few faint clay films; very strongly acid; clear wavy boundary. (10 to 16 inches thick)

BC--47 to 53 inches; dark reddish brown (5YR 3/3) and dark red (2.5YR 3/6) clay; weak fine subangular blocky structure; friable, slightly sticky, plastic; very strongly acid; 15 percent of horizon is saprolite; gradual wavy boundary. (5 to 8 inches thick)

C--53 to 60 inches; mottled reddish brown (5YR 4/3), red (2.5YR 4/6), very dark gray (5YR 3/1) and white (5YR 8/1) clay; massive; friable, slightly sticky, plastic; 90 percent saprolite; very strongly acid.

TYPE LOCATION: Sur SCD, Puerto Rico, 50 feet east of kilometer marker 67.0 on Highway 135.

RANGE IN CHARACTERISTICS: Thickness of the solum ranges from 40 to 64 inches. Thickness of the argillic horizon varies from 35 to 53 inches. Reaction is strongly or very strongly acid.

The A horizon has hue of 5YR or 2.5YR, value of 3 or 4, and chroma of 2 or 3. Texture is clay.

The Bt horizon has hue of 10R to 5YR, values of 3 or 4, and chroma of 2 to 4. Texture is clay.

The C horizon is clay, clay loam or silty clay loam saprolite of variegated colors.

COMPETING SERIES: The Aibonito and Daguey series are in the same family. The Aibonito and Daguey soils have B horizons with higher chromas of 6 to 8.

GEOGRAPHIC SETTING: The Alonso soils are moderately steep and very steep soils on side slopes and ridges of maturely dissected uplands with slope gradients from 12 to 60 percent. The soil formed in fine textured residuum weathered from very highly weathered basic volcanic reddish brown rocks. The climate is humid tropical with mean annual rainfall of 80 to 90 inches. The mean annual air temperature is 76 degrees F., at the type location.

GEOGRAPHICALLY ASSOCIATED SOILS: The competing Daguey and the Consumo, Humatas and Morado soils. Consumo and Humatas soils have thinner B2 horizons and higher chroma colors. Morado soils have thinner sola and

lack argillic horizons.

DRAINAGE AND PERMEABILITY: Well drained; medium to rapid runoff; moderate permeability.

USE AND VEGETATION: Most of the acreage is in coffee and pasture. Small acreage is in crops.

DISTRIBUTION AND EXTENT: Humid uplands of Puerto Rico. The series is of limited extent, with about 7,300 acres.

MLRA OFFICE RESPONSIBLE: Auburn, Alabama

SERIES ESTABLISHED: Soil Survey of Puerto Rico; 1943.

REMARKS: The classification was updated with the 4/91 draft from Clayey, oxidic, isohyperthermic Orthoxic Tropohumults to Clayey, oxidic, isohyperthermic Typic Haplohumults. The previous OSED date was 4/87.

Diagnostic horizons and features recognized in this pedon are:

Umbric epipedon - zone from 0 to 16 inches (Ap horizon)

Argillic horizon - zone from 6 to 47 inches (Bt horizons)

National Cooperative Soil Survey
U.S.A.

LOCATION CAGUABO PR

Established Series
Rev. GRB
06/2002

CAGUABO SERIES

The Caguabo series consists of shallow, well drained soils on side slopes of strongly dissected uplands. They formed in material that weathered from igenous rocks. Near the type location, the mean annual precipitation is about 80 inches and the mean annual temperature is 76 degrees F. Slopes range from 5 to 70 percent.

TAXONOMIC CLASS: Loamy, mixed, active, isohyperthermic, shallow Typic Eutrudepts

TYPICAL PEDON: Caguabo clay loam - native pasture and weeds. (Colors are for moist conditions.)

Ap--0 to 4 inches; dark grayish brown (10YR 4/2) clay loam; weak fine granular structure; friable, slightly sticky, slightly plastic; about 10 percent, by volume, igneous rock fragments; common fine roots; slightly acid; clear smooth boundary. (2 to 5 inches thick)

Bw--4 to 10 inches; brown (10YR 4/3) very gravelly clay loam; weak fine subangular blocky structure parting to weak fine granular; friable, slightly sticky, slightly plastic; about 60 percent, by volume, igneous rock fragments; few fine roots; slightly acid; clear smooth boundary. (4 to 8 inches thick)

C--10 to 16 inches; mixture of weathered and partially weathered igneous rock fragments and saprolite that can be penetrated with the spade. (0 to 7 inches thick)

R--16+ inches; consolidated igneous rock.

TYPE LOCATION: Oeste SCD, Puerto Rico. Approximately 1.5 miles northwest of the town of Anasco; about 300

feet north of intersection of Highways 2 and 110.

RANGE IN CHARACTERISTICS: Solum thickness ranges from 6 to 20 inches and depth to bedrock ranges from 10 to 20 inches. The soil is slightly acid throughout.

The A horizon has hue of 7.5YR to 2.5Y, value of 3 to 5, and chroma of 2 to 6. Texture is loam, clay loam, or their gravelly analogs.

The Bw horizon has hue of 7.5YR to 2.5Y, value of 2 to 6, and chroma of 3 to 6. Texture is gravelly to extremely analogs of silty clay loam, clay loam, or clay. Content of saprolite ranges from 0 to 20 percent, by volume.

The C horizon, where present, has hue of 7.5YR to 2.5Y, value of 2 to 6, and chroma of 3 to 6; or it has no dominant matrix color and is multicolored. Texture is gravelly or very gravelly analogs of sandy clay loam or clay loam. Content of saprolite ranges from 20 to 60 percent, by volume.

The Cr horizon, where present, is saprolite that is similar in color and texture as the C horizon.

The R layer is consolidated igneous rock.

COMPETING SERIES: There are no other known series in the same family.

GEOGRAPHIC SETTING: Caguabo soils are on lower positions of strongly dissected volcanic uplands at elevations below 1,800 feet or 550 meters. Slope range from 5 to 70 percent. They formed in fine-textured residuum or partially weathered igneous rocks. The climate is humid tropical. The average annual precipitation ranges from 75 to 85 inches and the average annual temperature ranges from 75 to 77 degrees F.

GEOGRAPHICALLY ASSOCIATED SOILS: These include the Juncos, Mabi, Maraquez, Maresua, Morado, Mucara, and Quebrada soils. All of these soils are deeper to bedrock. In addition, the Juncos, Mabi, and Mucara soils are have clayey, smectitic control sections. The Maraguez and Morado soils and have fine-loamy, mixed control sections. Maresua soils have mixed, clayey-skeletal control sections. Quebrada soils have mixed, clayey control sections.

DRAINAGE AND PERMEABILITY: Well drained; moderate permeability.

USE AND VEGETATION: Most areas of this soil are used for pasture. A few small areas are planted to woodland. Vegetation consists of native and introduced grasses, shrubs, and trees.

DISTRIBUTION AND EXTENT: Humid uplands of Puerto Rico. The series is of large extent.

MLRA OFFICE RESPONSIBLE: Auburn, Alabama.

SERIES ESTABLISHED: Humacao Survey Area, Puerto Rico; 1969.

REMARKS: These soils were formerly included in the Mucara series.

Diagnostic horizons and features recognized in this pedon:

Ochric epipedon - the zone from 0 to 4 inches (Ap horizon).

Cambic horizon - the zone from 4 to 10 inches (Bw horizon).

Lithic contact - hard bedrock at 16 inches (R layer).

MLRA: 270.

National Cooperative Soil Survey
U.S.A.

LOCATION CALLABO PR

Established Series
Rev. REG
06/2002

CALLABO SERIES

The Callabo series is well drained, moderately permeable upland soils. These soils have very dark grayish brown, thin, silty clay loam A horizons and brown, silty clay loam and clay loam B horizons over weathered volcanic rock that overlies harder, semiconsolidated rock at depths of more than 20 inches.

TAXONOMIC CLASS: Fine, mixed, superactive, isohyperthermic, shallow Typic Dystrustepts

TYPICAL PEDON: Callabo silty clay loam--guineagrass.
(Colors are for moist soil unless otherwise stated.)

Ap--0 to 5 inches; very dark grayish brown (10YR 3/2) silty clay loam; moderate medium granular structure, friable, slightly sticky, slightly plastic; many fine roots; 10 percent angular volcanic fragments; few wormholes, slightly acid; clear smooth boundary. (4 to 5 inches thick)

B2--5 to 13 inches; dark brown (10YR 4/3) 70 percent and very dark grayish brown (10YR 3/2) 30 percent, silty clay loam; weak medium and coarse subangular blocky structure; firm, slightly sticky, slightly plastic; common fine roots; 10 percent angular volcanic fragments, few wormholes; neutral, clear wavy boundary. (5 to 9 inches thick)

B3--13 to 19 inches; dark yellowish brown (10YR 4/4) clay loam; weak coarse subangular blocky structure; friable, sightly sticky, slightly plastic; few fine roots; 15 percent fine angular volcanic fragments; neutral; clear wavy boundary. (5 to 9 inches thick)

C--19 to 27 inches; highly weathered volcanic rock. There are few stringers of B horizon material, neutral; clear wavy

boundary. (6 to 12 inches thick)

R--27 to 40 inches; Semiconsolidated volcanic rocks.

TYPE LOCATION: Caribe SCD, Puerto Rico; 100 meters west of kilometer marker 2.3 of Highway 512.

RANGE IN CHARACTERISTICS: Thickness of the solum ranges from 14 to 24 inches. Depth to the semiconsolidated rock ranges from 20 to 36 inches. Mean annual soil temperature at 20 inches ranges from 73 degrees F. to 78 degrees F. These soils are slightly acid or neutral.

Colors of the A horizons range from very dark grayish brown (10YR 3/2) to brown (10YR 4/3). Silty clay loam is the dominant type. The colors of the B horizons range from dark brown (10YR 4/3) to yellowish brown (10YR 5/4).

The B horizons are clay loam or silty clay loam. Structure of the B horizons is weak and ranges from medium to coarse subangular blocky inclusive.

The C horizon consists of highly weathered and partially weathered volcanic rock.

COMPETING SERIES: These are the Victory and Vieques series in the same soil group and the Descalabrado, Diamond, Jacana, Maguayo series. The Victory soils are redder in hues 7.5YR. The Vieques soils have sandy clay loam B horizons, and are underlain by very gravelly coarse sand with 50 to 70 percent rock fragments. The Descalabrado and Diamond soils are underlain by hard rock at 23 inches or less. The Jacana and Maguayo soils have clay B horizons and have cracks when dry.

GEOGRAPHIC SETTING: The Callabo soils occur on strongly sloping to steep side slopes of strongly dissected uplands with slope gradients of 12 to 60 percent. The soil formed in moderately fine textured residuum weathered from basic volcanic rocks. The climate is semiarid. Average annual rainfall is 30 to 50 inches and the average annual temperature is 75 to 80 degrees F.

GEOGRAPHICALLY ASSOCIATED SOILS: These include the competing Jacana soils in addition to the Juana Diaz and Llanos soils. The Juana Diaz soils are coarser textured and are underlain by sandstones, and occur in similar side

slope positions. The Llanos soils are thicker, have argillic horizons, and occur in terrace positions below the Callabo soils.

DRAINAGE AND PERMEABILITY: Well drained, rapid runoff; moderate permeability.

USE AND VEGETATION: Largely in native grasses and used as pasture. A few acres are cultivated.

DISTRIBUTION AND EXTENT: Semiarid sections of Puerto Rico. The series is of moderate extent.

MLRA OFFICE RESPONSIBLE: Auburn, Alabama

SERIES ESTABLISHED: Ponce Survey Area, Puerto Rico, 1971.

REMARKS: These soils were formerly included in the Descalabrado series and classified in the Lithosols great soil group.

National Cooperative Soil Survey
U. S. A.

LOCATION CINTRONA PR

Established Series
Rev. REG
08/2000

CINTRONA SERIES

The Cintrona series have very dark gray clayey, plastic A horizons and dark gray clayey B horizons over gleyed mottled C horizons.

TAXONOMIC CLASS: Fine, mixed, superactive, isohyperthermic Typic Calciaquolls

TYPICAL PEDON: Cintrona clay - sugarcane, irrigated.
(Colors are for moist soil unless otherwise stated.)

Ap--0 to 8 inches; very dark gray (10YR 3/1) clay; weak fine and medium granular structure; firm, sticky, plastic; many fine roots; common fine volcanic and limestone fragments; strong effervescence; clear smooth boundary. (6 to 10 inches thick)

B1g--8 to 16 inches; dark gray (10YR 4/1) clay with few fine faint dark gray (N 4/) and few fine distinct dark yellowish brown (10YR 3/4) mottles; weak medium subangular blocky structure; firm, sticky, plastic; many fine roots; common fine volcanic and limestone fragments; few shell fragments; strong effervescence; clear smooth boundary. (6 to 10 inches thick)

B2g--16 to 24 inches; dark gray (10YR 4/1) clay with few fine distinct dark yellowish brown (10YR 3/4), common medium faint dark gray (N 4/) and few fine prominent dark greenish gray (5GY 4/1) mottles; weak coarse subangular blocky structure; firm, sticky, plastic; many decayed roots; common fine volcanic fragments; numerous soft calcium carbonate accumulations; violent effervescence; clear smooth boundary. (6 to 10 inches thick)

B3g--24 to 31 inches; very dark grayish brown (10YR 3/2) clay with few fine faint dark yellowish brown (10YR 3/4) and few fine prominent black (10YR 2/1) mottles; weak medium subangular blocky structure; firm, sticky, plastic; many decayed roots; common fine volcanic fragments; violent effervescence; clear smooth boundary. (6 to 8 inches thick)

C1g--31 to 38 inches; very dark brown (10YR 2/2) clay with few fine prominent dark greenish gray (5G 4/1), many medium distinct very dark gray (N 3/), and few fine faint dark yellowish brown (10YR 4/4) mottles; massive; firm, sticky, plastic; many decayed roots; violent effervescence; abrupt smooth boundary. (6 to 10 inches thick)

C2g--38 to 46 inches; dark greenish gray (5G 4/1) 60 percent; greenish gray (5GY 5/1) 15 percent; dark gray (5Y 4/1) 10 percent, very dark gray (N 3/) 10 percent, and dark yellowish brown (10YR 4/5) clay; massive; firm, slightly sticky, plastic; many decayed roots; violent effervescence; abrupt smooth boundary. (6 to 10 inches thick)

C3g--46 to 60 inches; dark greenish gray (5GY 2/1) clay loam with few fine faint prominent dark yellowish brown (10YR 4/4), few fine distinct light olive brown (2.5Y 5/6), and dark greenish gray (5G 4/1) mottles; massive; firm, slightly sticky, plastic; strong effervescence.

TYPE LOCATION: Caribe SCD. 150 feet east of dirt road which is 0.8 mile north of kilometer marker 113.0 of Highway No. 1.

RANGE IN CHARACTERISTICS: Thickness of the solum ranges from 24 to 38 inches. Clay is the dominant texture throughout. Depth to water table varies from 36 to 60 inches after drainage.

Colors of the A horizon have hues of 10YR, values of 2 or 3 and chroma of 1. May have gray and greenish gray mottles in the A horizon.

The B horizons have hues of 10YR or 2.5Y, values of 3 or 4 and chroma of 0 or 1.

The C horizons are dominantly gley colors with mottles of dark gray, dark yellowish brown, olive brown, and red. The B horizons range from medium to coarse subangular blocky structure. These soils have sticky and plastic solum and slightly sticky and plastic C horizons. Effervescence varies from strong to violent.

COMPETING SERIES: These are the Castro, Constancia, Kaloko, Magna, Salt Lake, and Sunnyvale series. The Constancia soils are better drained and have colors of higher chromas in the A and B horizons. The Kaloko soils have a carbonatic mineralogy. The other soils are cooler and have greater fluctuations of soil temperatures.

GEOGRAPHIC SETTING: The Cintrona soils occupy concave slope positions in the level floodplains with slope gradients with less than 1 percent. The soil formed in calcareous fine textured sediments derived from volcanic and limestone rocks. Climate is semiarid. The average annual rainfall averages 25 to 40 inches and the mean annual temperature is 78 to 80 degrees F.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Cortada, Jacaguas, Machuelo, and San Anton and the competing Constancia soils, all of which occur in the flood plain positions. The Cortada and San Anton soils have loamy unmottled profiles. The Jacaguas soils have loamy profiles, are noncalcareous and are underlain by coarse gravelly fragments at shallow depth. The Machuelo soils have lighter colored surface horizons.

DRAINAGE AND PERMEABILITY: Very poorly drained; slow runoff; very slow permeability.

USE AND VEGETATION: Most acreage is planted to sugarcane which is irrigated.

DISTRIBUTION AND EXTENT: Semiarid portion of Puerto Rico. The series is of minor extent.

MLRA OFFICE RESPONSIBLE: Auburn, Alabama

SERIES ESTABLISHED: Puerto Rico; 1936.

REMARKS: These soils were formerly classified in the Alluvial great soil group.

National Cooperative Soil Survey
U. S. A.

LOCATION CONSTANCIA PR

Established Series
Rev. GRB
06/2002

CONSTANCIA SERIES

The Constancia series consists of very deep, somewhat poorly drained, slowly permeable soils on flood plains. They formed in fine-textured sediments derived from volcanic and limestone rocks. Near the type location, the mean annual temperature is about 79 degrees F., and the mean annual precipitation is about 37 inches. Slopes range from 0 to 2 percent.

TAXONOMIC CLASS: Fine, smectitic, isohyperthermic Aeric Calciaquolls

TYPICAL PEDON: Constancia silty clay--sugarcane. (Colors are for moist soil.)

Ap--0 to 12 inches; very dark grayish brown (10YR 3/2) silty clay, weak fine and medium granular structure; firm; slightly sticky; plastic; many fine roots; few fine volcanic fragments; strongly effervescent; moderately alkaline; abrupt smooth boundary. (8 to 14 inches thick)

Bw--12 to 17 inches; very dark grayish brown (10YR 3/2) silty clay; weak fine and medium subangular blocky structure; firm; slightly sticky, plastic; many fine roots; few fine volcanic fragments; few fine distinct yellowish brown (10YR 5/6) masses of iron accumulation; common fine distinct dark gray (10YR 4/1) areas of iron depletions; strongly effervescent; moderately alkaline; clear smooth boundary. (4 to 6 inches thick)

Bk1--17 to 24 inches; about 30 percent very dark grayish brown (10YR 3/2), about 30 percent yellowish brown (10YR 5/6), about 30 percent dark gray (5Y 4/1), and about 10 percent dark yellowish brown (10YR 3/4) silty clay; weak medium and coarse subangular blocky structure; firm; slightly sticky, plastic; few soft small rounded masses of calcium carbonate; few fine roots; few fine volcanic fragments; few fine shell fragments; the areas in shades of brown are masses

of iron accumulation and the areas in shades of gray are iron depletions; strongly effervescent; moderately alkaline; clear smooth boundary.

Bk2--24 to 29 inches; about 40 percent very dark grayish brown (10YR 3/2), about 40 percent dark gray (5Y 4/1), about 15 percent yellowish brown (10YR 5/6), and about 5 percent dark yellowish brown (10YR 3/4) silty clay; weak medium subangular blocky structure; firm; slightly sticky, plastic; few fine roots; few fine volcanic fragments; few soft small rounded masses of calcium carbonate; few fine shell fragments; few fine limestone fragments; the areas in shades of brown are masses of iron accumulation and the areas in shades of gray are iron depletions; strongly effervescent; moderately alkaline; clear smooth boundary. (Combined thickness of the Bk horizons ranges from 12 to 18 inches)

Cg1--29 to 37 inches; dark gray (5Y 4/1) clay; firm; sticky, plastic; few fine roots; few fine volcanic fragments; few fine shell fragments; few fine limestone fragments; many medium distinct yellowish brown (10YR 5/6) and common medium distinct very dark grayish brown (10YR 3/2) masses of iron accumulation; strongly effervescent; moderately alkaline; clear smooth boundary.

Cg2--37 to 50 inches; dark gray (5Y 4/1) clay; massive; firm; sticky, plastic; few fine volcanic fragments; few fine shell fragments; few fine limestone fragments; many medium distinct brownish yellow (10YR 6/6) and few fine distinct dark yellowish brown (10YR 4/6) masses of iron accumulation; few fine distinct dark greenish gray (5G 6/1) areas of iron depletions; strongly effervescent; moderately alkaline; clear smooth boundary.

Cg3--50 to 65 inches; about 40 percent yellowish brown (10YR 5/4), about 20 percent dark gray (5Y 4/1), about 15 percent dark bluish gray (5B 4/1), about 15 percent bluish gray (5B 5/1), and about 10 percent brownish yellow (10YR 6/6) clay; massive; firm; sticky, plastic; few fine volcanic fragments; few fine limestone fragments; the areas in shades of brown and yellow are masses of iron accumulation and the areas in shades of gray are areas of iron depletions; violently effervescent; moderately alkaline.

TYPE LOCATION: Sur SCD, Puerto Rico. Approximately 1.6 miles south of kilometer marker 125.1 on Highway 1.

RANGE IN CHARACTERISTICS: Thickness of the solum ranges from 24 to 38 inches. Reaction is slightly alkaline to moderately alkaline throughout. Effervescence is strong or violent throughout the profile.

The A or Ap horizon has hue of 10YR, value of 2 or 3, and chroma of 2 or 3. Texture is silty clay or clay.

The Bw horizon has hue of 10YR, value of 3, and chroma of 2 or 3. Redoximorphic features in shades of gray, yellow, and brown range from common to many. In some pedons, there is no dominant color and is multicolored in shades of gray, yellow, and brown. Texture is silty clay or clay.

The Bk horizons have hue of 10YR or 2.5Y, value of 3 or 4, and chroma of 2 to 4. Redoximorphic features in shades of gray, yellow, and brown range from common to many. In some pedons, there is no dominant color and is multicolored in shades of gray, yellow, and brown. Texture is silty clay or clay.

The Cg horizons have hue of 2.5Y or 5Y, value of 4 to 6, and chroma of 1 or 2. Redoximorphic features in shades of yellow, brown, and gray range from few to many. In many pedons, there is no dominant color and is multicolored in shades of gray, brown, and yellow. Texture is silty clay or clay.

COMPETING SERIES: There are no other known series in the same family.

GEOGRAPHIC SETTING: Constancia soils are in river flood plains. They formed in calcareous fine-textured sediments derived from volcanic and limestone rocks. The climate is semiarid. Slopes range from 0 to 2 percent. The average annual temperature ranges from 78 to 80 degrees F., and the average annual rainfall ranges from 25 to 40 inches

GEOGRAPHICALLY ASSOCIATED SOILS: These include the Cintrona, Cortada, Jacaguas, Machuelo, and San Anton series. All of these soils are in flood plains. The very poorly drained Cintrona soils are on similar to slightly lower positions. The well drained Cortada and San Anton soils are on higher positions and have fine-loamy subsoils. The excessively drained Jacaguas soils are on higher positions, are loamy-skeletal, and are noncalcareous. Machuelo soils are on similar positions but do not have a mollic epipedon.

DRAINAGE AND PERMEABILITY: Somewhat poorly drained; slow permeability.

USE AND VEGETATION: Most areas of Constancia soils are used for cropland and pasture land. Vegetation includes guineagrass and other native and introduced species.

DISTRIBUTION AND EXTENT: Semiarid areas of southern Puerto Rico. The series is of minor extent.

MLRA OFFICE RESPONSIBLE: Auburn, Alabama.

SERIES ESTABLISHED: Ponce Survey Area, Puerto Rico; 1971.

REMARKS: These soils were formerly classified in the Alluvial great soil group.

Diagnostic horizons and features recognized in this pedon are:

Mollic Epipedon - the zone from 0 to 17 inches (Ap and Bw horizons.)

Calcc horizon - the zone from 17 to 38 inches (Bk1 and Bk2 horizons.)

National Cooperative Soil Survey
U.S.A.

LOCATION CONSUMO PR

Established Series
Rev. BCD
02/98

CONSUMO SERIES

The Consumo series consists of moderately deep to saprolite, well drained, moderately permeable soils formed in residuum from basic volcanic rocks. They are steep to very steep soils on side slopes and ridges of maturely dissected uplands. Slopes range from 20 to 60 percent. The mean annual precipitation is about 76 inches and the mean annual temperature is about 77 degrees F.

TAXONOMIC CLASS: Fine, mixed, semiactive, isohyperthermic Typic Haplohumults

TYPICAL PEDON: Consumo clay--Pangolagrass. (Colors are for moist soil unless otherwise stated.)

Ap--0 to 6 inches; reddish brown (5YR 4/4) clay; moderate medium granular structure; slightly hard friable, slightly sticky and slightly plastic; many fine roots; very strongly acid, clear smooth boundary. (4 to 8 inches thick)

Bt1--6 to 14 inches; red (2.5YR 4/8) clay; weak fine subangular blocky structure; friable, slightly sticky and slightly plastic; common fine roots; common fine pores and root channels; thin patchy clay films; very strongly acid; gradual smooth boundary. (6 to 8 inches thick)

Bt2--14 to 20 inches; red (2.5YR 4/8) rubbed color clay; weak fine subangular blocky structure; friable, nonsticky, slightly plastic; few fine roots; thin patchy clay films; 50 percent of the horizon consists of saprolite; very strongly acid; gradual smooth boundary. (4 to 8 inches)

C--20 to 60 inches; variegated colors of the saprolite, which include red (2.5YR 4/8, 5/8), yellow (10YR 7/8), brown (7.5YR 5/4), light gray (10YR 7/1), silty clay loam; massive; black coatings on some faces; very friable, nonsticky, slightly

plastic; very strongly acid. Original rock structure is visible and weathered rock fragments can be easily broken between fingers.

TYPE LOCATION: Oeste SCD, Puerto Rico; 8 miles east of the city of Mayaguez; 100 feet west and 50 feet south of kilometer marker 13.5 on Highway 106.

RANGE IN CHARACTERISTICS: Thickness of the solum ranges from 14 to 24 inches. Thickness of the agrillic horizon varies from 10 to 16 inches. This soil is strongly to very strongly acid throughout. The mean annual soil temperature ranges from 74 to 76 degrees F.

The A horizon has hues of 5YR or 2.5YR, values of 4 or 5, and chromas of 4 to 6. It is slightly sticky and slightly plastic or plastic.

The Bt horizon has hues of 5YR or 2.5YR, values of 4 or 5, and chroma of 6 or 8. It is clay in the upper part and clay or silty clay in the lower part. Structure varies in grade from weak to moderate subangular blocky. It is slightly sticky to nonsticky, and slightly plastic. Clay films vary from thin patchy to thin discontinuous. Saprolite ranges from 10 to 60 percent in the lower part.

The BC horizon, where present is clay or silty clay. Saprolite ranges from 40 to 80 percent. Consistence is nonsticky to slightly sticky.

COMPETING SERIES: There are no other known series in the same family. The Caspar, Consejo, Corozal, Corozo, Ingenio, Jagueyes, Lirios, Maricao, Moca, Patillas, and Rio Piedras series are similar soils in related families. The Caspar, Consejo, Lirios and Rio Piedras soils have argillic horizons thicker than 16 inches. The Corozal soils have thicker argillic horizons and low chroma mottles. The Corozo, Ingenio, and Jagueyes soils have thicker argillic horizons and CEC values lower than 24 meq/100 grams of clay. The Maricao soils have colder soil temperatures, lower than 72 degrees F. (mean annual). The Moca soils have thicker argillic horizons and also have higher COLE values and cracks when dry. The Patillas soils have coarser textured profiles with less than 35 percent clay.

GEOGRAPHIC SETTING: The Consumo soils are steep to very steep soils on side slopes and ridges. Slope gradients range from 20 to 60 percent. The soils formed in fine over coarser textured residuum weathered from basic volcanic rock.

The climate is humid tropical. The average annual precipitation is 73 to 80 inches, and the mean annual temperature is 75 to 78 degrees F.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Anones, Daguey, Humatas, Morado, and Mucara series. The Anones soils have weaker structure in the B horizons, lack clay skins, and are pinkish colored. Daguey and Humatas soils are deeper and have argillic horizons thicker than 16 inches. Morado and Mucara soils have coarser textured profiles, are less acid, and shallower to the basic volcanic rock.

DRAINAGE AND PERMEABILITY: Well drained; rapid runoff; moderate permeability.

USE AND VEGETATION: Used for coffee, pasture and food crops.

DISTRIBUTION AND EXTENT: Humid uplands of Puerto Rico. The series is of large extent.

MLRA OFFICE RESPONSIBLE: Auburn, Alabama

SERIES ESTABLISHED: Ponce Survey Area, Puerto Rico; 1971.

REMARKS: The classification was updated with the 4/91 draft from Clayey, mixed, isohyperthermic Dystropeptic Haplohumults to Clayey, mixed, isohyperthermic Typic Haplohumults. The previous OSED date was 10/75.

Diagnostic horizons and features recognized in this pedon:

Ochric epipedon - zone from 0 to 6 inches (Ap horizon)

Argillic horizon - zone from 6 to 20 inches (Bt horizons)

National Cooperative Soil Survey
U.S.A.

LOCATION CORTADA PR

Established Series
Rev. JLL/GRB
06/2002

CORTADA SERIES

The Cortada series consist of very deep, well drained, moderately permeable soils on flood plains. They formed in stratified loamy sediments that are derived from volcanic and limestone rocks. Near the type location, the mean annual temperature is about 79 degrees F., and the mean annual precipitation is about 31 inches. Slopes range from 0 to 2 percent.

TAXONOMIC CLASS: Fine, smectitic, isohyperthermic Cumulic Haplustolls

TYPICAL PEDON: Cortada silty clay loam - irrigated sugarcane. (Colors are for moist soil unless otherwise stated.)

Ap--0 to 10 inches; very dark grayish brown (10YR 3/2) silty clay loam; weak fine granular structure; firm; slightly sticky, plastic; many fine roots; few shell fragments; slightly effervescent; moderately alkaline; abrupt smooth boundary. (8 to 12 inches thick)

Bk1--10 to 18 inches; dark brown (10YR 3/3) silty clay loam; weak medium subangular blocky structure; firm; slightly sticky, plastic; many fine roots; few shell fragments; slightly effervescent; moderately alkaline; clear smooth boundary.

Bk2--18 to 28 inches; dark brown (10YR 3/3) silty clay loam; weak fine and medium subangular blocky structure; firm; slightly sticky, plastic; few fine roots; few shell fragments; strongly effervescent; moderately alkaline; abrupt smooth boundary. (16 to 22 inches (Combined thickness of the Bk horizons ranges from 16 to 22 inches)

C1--28 to 38 inches; brown (10YR 4/3) silt loam; massive; friable, slightly sticky, slightly plastic; few fine roots; strongly effervescent; moderately alkaline; clear wavy boundary.

C2--38 to 48 inches; brown (10YR 4/3) silty clay loam; massive; friable, slightly sticky, plastic; few fine roots; violently effervescent; moderately alkaline; abrupt smooth boundary.

C3--48 to 68 inches; brown (10YR 4/3) silt loam; massive; friable; slightly sticky, plastic; few fine roots; strongly effervescent; moderately alkaline.

TYPE LOCATION: Caribe SCD, Puerto Rico; 7.5 meters west of kilometer marker 0.8 of Highway No. 536.

RANGE IN CHARACTERISTICS: Solum thickness ranges from 23 to 34 inches. Reaction ranges from slightly alkaline to moderately alkaline in the A or Ap horizons and moderately alkaline in the Bk and C horizons.

The A or Ap horizon has hue of 10YR, value of 3 and chroma of 2 or 3. Texture is loam, silt loam, or silty clay loam.

The Bk horizon has hue of 10YR, value of 3 or 4, and chroma of 3 or 4. Textures range from silt loam or silty clay loam.

The C horizon has hue of 7.5YR or 10YR, value of 4, and chroma of 3 or 4. Texture is sandy loam, loam, silt loam, or silty clay loam.

COMPETING SERIES: There are no known series in the same family.

GEOGRAPHIC SETTING: The Cortada soils are on flood plains. They formed in loamy sediments that weathered from volcanic and limestone rocks. The climate is tropical semiarid. Slopes range from 0 to 2 percent. The average annual rainfall ranges from 25 to 40 inches and the average annual temperature ranges from 78 to 80 degrees F.

GEOGRAPHICALLY ASSOCIATED SOILS: These include the Constancia, Jacaguas, Machuelo, and San Anton soils. The somewhat poorly drained Constancia and the poorly drained Machuelo soils are on slightly lower positions and have clayey subsoils. Jacaguas soils are near the stream channels and are loamy-skeletal. San Anton soils are on similar positions but do not have calcic horizons.

DRAINAGE AND PERMEABILITY: Well drained; moderate permeability.

USE AND VEGETATION: Cropland (mostly irrigated) and pastureland. Vegetation includes native and introduced grasses and shrubs.

DISTRIBUTION AND EXTENT: Semiarid sections of southern Puerto Rico. The series is of minor extent.

MLRA OFFICE RESPONSIBLE: Auburn, Alabama.

SERIES ESTABLISHED: Ponce Survey Area, Puerto Rico; l971.

REMARKS: diagnostic horizons and other features recognized in this pedon include:

Mollic epipedon - the zone from 0 to 28 inches (Ap, Bk1 and Bk2 horizons)

Calcic horizon - the zone from 10 to 28 inches (Bk1 and Bk2 horizons)

Flooding is occasional.

These soils were formerly included in the San Anton series and classified in the Alluvial great soil group.

National Cooperative Soil Survey
U.S.A.

LOCATION CUYON PR

Established Series
Rev. REG
06/2002

CUYON SERIES

The Cuyon series consists of dark brown, granular, friable, loam A horizons over a mixture of sand and medium and coarse gravel in varying proportions.

TAXONOMIC CLASS: Sandy-skeletal, mixed, isohyperthermic Torrifluventic Haplustolls

TYPICAL PEDON: Cuyon loam - guineagrass. (Colors are for moist soil unless otherwise stated.)

Ap--0 to 11 inches; dark brown (10YR 3/3) loam; weak fine granular structure; friable, slightly sticky, slightly plastic; many fine roots; few rounded rock fragments; 1 to 2 inches (25 to 50 cm) in diameter; neutral, clear irregular boundary. (8 to 12 inches thick)

C1--11 to 17 inches; consists of 70 percent medium and coarse gravel, 25 percent coarse sand, and 5 percent silt by volume. (5 to 10 inches thick)

C2--17 to 24 inches; consists of dark brown (10YR 3/3) gravelly coarse sand with less than 10 percent silt.

TYPE LOCATION: Caribe SCD, Puerto Rico, 40 meters east of kilometer marker 39.05 of Highway No. 14.

RANGE IN CHARACTERISTICS: Thickness of A horizon and depth to the coarse materials range from 8 to 12 inches (20-30 cm). The A horizons are very dark grayish brown, (10YR 3/2) or dark brown (10YR 3/3). Loam is the dominant type. Structure is weak fine or moderate medium granular.

The C horizons have varying amounts of sand and gravel and less than 10 percent silt. These soils are neutral or mildly alkaline. The percent of gravel ranges from 50 to 80 percent.

COMPETING SERIES: These are the Jacaguas, Mokuleia, Reilly, San Anton, and San German series. The Jacaguas soils have more clay in the control section and have cambic horizons. The Mokuleia soils lack the gravel and have carbonatic mineralogy. The Reilly soils are acid and occur in the more humid areas. The San Anton soils are moderately fine textures. The San German soils are calcareous and are underlain by hard limestone at depths of 20 inches or less.

GEOGRAPHIC SETTING: The Cuyon soils occur very close to the river banks on nearly level to gently sloping terrain with slope gradients of 0 to 5 percent. The soil formed in stratified coarse textures sediments of mixed origin. The climate is semiarid. The mean annual precipitation ranges for 25 to 45 inches and the mean annual temperature is 78 to 80 degrees F.

GEOGRAPHICALLY ASSOCIATED SOILS: These include the competing Jacaguas and San Anton soils and the Constancia, Cortada, and Machuelo soils, all of which occur in flood plains. The Constancia and Machuelo soils are wetter and have low chroma mottles. Cortada soils have B horizons and have thicker profiles.

DRAINAGE AND PERMEABILITY: Excessively drained; slow runoff; rapid permeability.

USE AND VEGETATION: Mostly in native pastures, guinea and pajon grasses.

DISTRIBUTION AND EXTENT: Semiarid flood plains of Puerto Rico. The series is of minor extent.

MLRA OFFICE RESPONSIBLE: Auburn, Alabama

SERIES ESTABLISHED: Ponce Survey Area, Puerto Rico; l971.

REMARKS: The Cuyon soils were formerly classified in the Alluvial great soil group.

National Cooperative Soil Survey
U.S.A

LOCATION DAGUEY PR

Established Series
Rev. BCD
06/2002

DAGUEY SERIES

The Daguey series consists of very deep, well drained, moderately permeable soils on sideslopes, ridgetops and footslopes in volcanic uplands. They formed in fine textured residuum weathered from volcanic rock. Slopes range from 2 to 40 percent. The mean annual precipitation is about 85 inches and the mean annual temperature is about 76 degrees F.

TAXONOMIC CLASS: Very-fine, kaolinitic, isohyperthermic Inceptic Hapludox

TYPICAL PEDON: Daguey clay--pasture. (Colors are for moist soil.)

Ap--0 to 10 inches; brown (7.5YR 4/4) clay; weak medium subangular blocky parting to moderate fine granular structure; firm, slightly sticky, slightly plastic; very strongly acid; abrupt wavy boundary. (8 to 12 inches thick)

Bo1--10 to 14 inches; reddish brown (5YR 5/4) clay; weak medium subangular blocky structure; firm, slightly sticky, slightly plastic; thin patchy clay films; very strongly acid; clear smooth boundary. (3 to 5 inches thick)

Bo2--14 to 23 inches; yellowish red (5YR 4/6) clay; few medium distinct yellowish brown (10YR 5/4) mottles; moderate medium subangular and angular blocky structure; firm, slightly sticky, slightly plastic; thin patchy clay films; very strongly acid; clear smooth boundary. (6 to 11 inches thick)

Bo3--23 to 31 inches; red (2.5YR 4/6) clay; strong medium and fine subangular blocky structure; firm, slightly sticky, slightly plastic; thin continuous clay films on ped faces; very strongly acid; gradual smooth boundary. (6 to 10 inches thick)

Bo4--31 to 43 inches; red (2.5YR 4/6) clay; strong medium and fine subangular blocky structure; firm, slightly sticky,

slightly plastic; thin patchy clay films; very strongly acid; gradual smooth boundary. (8 to 14 inches thick)

Bo5--43 to 59 inches; red (2.5YR 4/6) clay; moderate fine subangular blocky structure; firm, slightly sticky, slightly plastic; thin patchy clay films; very strongly acid; gradual smooth boundary. (10 to 20 inches thick)

Bo6--59 to 72 inches; red (2.5YR 4/6) clay; weak medium and fine subangular blocky structure; firm, slightly sticky, slightly plastic; very thin patchy clay films; few small angular fragments of rock; very strongly acid; clear smooth boundary. (10 to 16 inches thick)

C--72 to 86 inches; yellowish red (5YR 4/6) silty clay loam; common fine strong brown (7.5YR 5/6) and reddish yellow (7.5YR 6/6) mottles; massive with evidence of original rock structure; friable, slightly sticky, slightly plastic; very strongly acid; gradual smooth boundary. (12 to 18 inches thick)

Cr--86 to 90 inches; Saprolite with well defined rock structure, similar in color and texture to C1 horizon.

TYPE LOCATION: Cibuco SCD, Puerto Rico; 40 feet west of Highway 113, 80 feet south of road junction to house.

RANGE IN CHARACTERISTICS: The solum is 60 to 80 inches thick. The soil is strongly or very strongly acid. Catlon exchange capacity ranges from 8 to 16 meq/100 grams of clay in the kandic horizon. The organic carbon content in the upper 6 inches of the kandic horizon ranges from 1.0 to 1.6.

The Bo horizon has hue of 10R or 2.5YR, value of 4 to 5 and chroma of 6 through 8. Yellowish brown mottles are few or common and are more evident in the upper B horizons.

COMPETING SERIES: The Aibonito and Alonso series are in the same family. The Aibonito soils have yellower B horizons. The Alonso soils have darker colors with chroma of 3 or less.

GEOGRAPHIC SETTING: The Daguey soils are gently sloping to steep soils on stable hilltops, side slopes, and foot slopes of the volcanic uplands with slope of 2 to 40 percent. The soil is formed in fine textured residuum from very highly weathered basic volcanic rocks. The climate is humid tropical. The average annual precipitation ranges from 70 to 85 inches and the mean annual temperature ranges from 74 to 76 degrees F.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Consumo and Humatas soils. The Consumo soils occur on steeper less stable surfaces and have thinner B horizons. The Humatas soils have a CEC of more than 24 megs.

DRAINAGE AND PERMEABILITY: Well drained; medium to rapid runoff; moderate permeability.

USE AND VEGETATION: Coffee, pasture and food crops.

DISTRIBUTION AND EXTENT: Humid uplands of Puerto Rico. The series is of moderate extent, about 16,000 acres.

MLRA OFFICE RESPONSIBLE: Auburn, Alabama

SERIES ESTABLISHED: Ponce Survey Area, Puerto Rico; 1971.

REMARKS: The classification was updated with the 4/91 draft from Clayey, oxidic, isohyperthermic Orthoxic Tropohumults to Very-fine, mixed, isohyperthermic Typic Kandiudox. The previous OSED was dated 4/87.

Diagnostic horizons and features recognized in this pedon are:

Ochric epipedon - zone from 0 to 10 inches (A horizon)

Oxic horizon - zone from 10 to 72 inches (Bo horizons)

ADDITIONAL DATA: Characterization data are available for pedon S61PR-8-3 and S61PR-8-6.

National Cooperative Soil Survey
U.S.A.

LOCATION ENSENADA PR

Established Series
Rev. RER
06/2002

ENSENADA SERIES

The Ensenada series consists of deep, well drained, moderately permeable soils on fluvial deposits adjacent to limestone hills in coastal plains. They formed in fluvial deposits. Slopes range from 2 to 12 percent. Mean annual precipitation is 25 inches and the mean annual temperature is 80 degrees F.

TAXONOMIC CLASS: Clayey-skeletal, mixed, superactive, isohyperthermic Calcidic Argiustolls

TYPICAL PEDON: Ensenada gravelly clay - sugarcane
(Colors are for most soil unless otherwise stated.)

Ap--0 to 5 inches; dark reddish brown (5YR 3/3) gravelly clay; moderate fine granular structure; firm, sticky, plastic; many fine roots; few cobbles and rocks in the surface; 40 percent limestone gravel; slight effervescence, mildly alkaline; clear smooth boundary. (4 to 7 inches thick)

Bt1--5 to 11 inches; dark reddish brown (5YR 3/4) gravelly clay; moderate fine subangular blocky structure; firm, sticky, plastic; common fine roots; common thin patchy clay films; 40 percent limestone gravel; slight effervescence, mildly alkaline; clear smooth boundary. (5 to 8 inches thick)

Bt2--11 to 60 inches; yellowish red (5YR 5/8) very gravelly clay; massive; friable, sticky, plastic; 60 percent by volume of horizon is rounded and subrounded limestone gravel coated with clay and calcium carbonate; violent effervescence, moderately alkaline.

TYPE LOCATION: Sur SCD, Puerto Rico, 100 feet west of kilometer marker 3.75 of Highway No. 335.

RANGE IN CHARACTERISTICS: Thickness of the solum is more than 60 inches. The amount of limestone gravel in the solum ranges from 35 to 60 percent by volume.

The A horizon has hue of 5YR or 7.5YR, value of 3 and chroma of 2 or 3.

The Bt horizon has in hue of 5YR or 2.5YR, value of 3, 4, or 5 and chroma of 4 and higher.

COMPETING SERIES: There are no other series in the same family.

GEOGRAPHIC SETTING: The Ensenada soils occur on a truncated remnant of a fluvial deposit adjacent to the limestone hills with a slope gradient of 2 to 12 percent. The soil formed in a mixture of clay and rounded gravels. The climate is semiarid. The mean annual precipitation ranges from 20 to 30 inches and the mean annual temperature is 80 degrees F.

GEOGRAPHICALLY ASSOCIATED SOILS: These soils occupy a unique area in that there are no associated soils.

DRAINAGE AND PERMEABILITY: Well drained; medium runoff; moderate permeability.

USE AND VEGETATION: Irrigated sugarcane or pasture.

DISTRIBUTION AND EXTENT: Semiarid coastal plain of Puerto Rico. This series is of minor extent.

MLRA OFFICE RESPONSIBLE: Auburn, Alabama

SERIES ESTABLISHED: Puerto Rico; l936.

REMARKS: Prior to this revision, this series included deep soils with gravel, red soils shallow to limestone rock and limestone rock land.

Diagnostic horizons and features recognized in this pedon are:

Mollic epipedon - zone from 0 to 5 inches (Ap horizon)

Argillic horizon - zone from 5 to 60 inches (Bt1, Bt2 horizons)

National Cooperative Soil Survey
U.S.A.

LOCATION FE PR

Established Series
Rev. JLL/GRB
08/1999

FE SERIES

The Fe series consists of very deep, somewhat poorly drained, very slowly permeable soils on alluvial fans in valleys. They formed in clayey sediments that weathered from igneous rocks and limestone. Near the type location, the mean annual precipitation is about 35 inches and the mean annual temperature is about 77 degrees F. Slopes range from 0 to 2 percent.

TAXONOMIC CLASS: Fine, smectitic, isohyperthermic Sodic Haplusterts

TYPICAL PEDON: Fe clay - native grass. (Colors are for moist soil unless otherwise stated.)

Ap--0 to 7 inches; dark reddish brown (5YR 3/2) clay; moderate fine angular blocky parting to moderate fine granular structure; very hard; firm; sticky; plastic; common fine roots; calcareous, moderately alkaline; clear wavy boundary.

A--7 to 17 inches; dark reddish brown (5YR 3/2) and (5YR 3/3) clay; moderate medium angular blocky structure; very hard; extremely firm; sticky, plastic; common fine roots along structural faces; many pressure faces on surfaces of peds; about 2 percent, by volume, igneous pebbles; strongly effervescent; strongly alkaline; clear smooth boundary. (Combined thickness of the A and Ap horizons ranges from 11 to 20 inches.)

Bssz1--17 to 28 inches; dark reddish brown (5YR 3/3) clay; moderate medium angular blocky structure; firm; slightly sticky; plastic, few fine roots; common small slickensides having distinct polished and grooved surfaces; common fine salt crystals; about 2 percent, by volume, igneous pebbles; strongly effervescent; strongly alkaline; clear smooth boundary.

Bssz2--28 to 42 inches; dark reddish gray (5YR 4/2) clay; moderate fine and medium angular blocky structure; firm,

slightly sticky, plastic, few fine roots; common medium slickensides having distinct polished and grooved surfaces; few fine salt crystals; about 2 percent, by volume, igneous pebbles; strongly effervescent; strongly alkaline; diffuse wavy boundary. (Combined thickness of the Bssz horizons ranges from 16 to 32 inches.)

Bss--42 to 56 inches; dark reddish gray (5YR 4/2) clay; moderate fine and medium angular blocky structure; firm; slightly sticky, plastic, about 5 percent, by volume, igneous pebbles; common medium slickensides having distinct polished and grooved surfaces; strongly effervescent; strongly alkaline.

TYPE LOCATION: Suroeste SCD, Lajas Valley Area, Puerto Rico. Approximately 4.3 miles south of the city of Sabana Grande from the intersection of P.R. Hwy 102 and P.R. Hwy 121; approximately 2.1 miles southwest from the intersection of P.R. Hwy 2 and P.R. Hwy 117; about 1,000 feet west of dirt road (Municipality limits boundary between Lajas and Guanica) in hayfield. Sabana Grande topographic quadrangle; lat. 18 degrees 01 minutes 04 seconds N.; long. 66 degrees 57 minutes 46 seconds W. PRD 1940.

RANGE IN CHARACTERISTICS: Solum thickness is more than 60 inches. Reaction is moderately alkaline to strongly alkaline in the A horizons and strongly alkaline in the Bss and Bssz horizons. Depth to moderate salinity ranges from 5 to 8 inches.

The A or Ap horizon has hue of 5YR to 10YR, value of 2 or 3, and chroma of 2 or 3.

The Bss and Bssz horizons have hue of 5YR or 7.5YR, value of 3 through 5, and chroma of 2 through 4. The Bssz horizons are moderately saline and the ESP ranges from 25 to 40.

COMPETING SERIES: Hogensborg soils are in the same family. The well drained Hogensborg soils have more sodium within 40 inches of the surface.

GEOGRAPHIC SETTING: Fe soils are on alluvial fans in valleys. They formed in clayey sediments that weathered from igneous rocks and limestone. Slopes range from 0 to 2 percent. The climate is tropical semiarid. The average annual precipitation ranges from 32 to 38 inches and the average annual temperature ranges from 76 to 78 degrees F.

GEOGRAPHICALLY ASSOCIATED SOILS: These include Aguirre, Cartagena, Fraternidad, and Guanica soils.

Aguirre soils and the moderately well drained Fraternidad soils are nonsaline. Cartagena soils have mixed mineralogy. Guanica soils have more clay in the control section and have gypsum below a depth of 32 inches.

DRAINAGE AND PERMEABILITY: Somewhat poorly drained; very slow permeability.

USE AND VEGETATION: Most areas of Fe soil are used for pasture. Some small areas are used for sugarcane. The vegetation consists of Angletongrass, Paraguita grasses, Rayo, Mesquite, weeds, salt-tolerant plants, other native and introduced species.

DISTRIBUTION AND EXTENT: Coastal plains of southern Puerto Rico. This soil is of small extent.

MLRA OFFICE RESPONSIBLE: Auburn, Alabama.

SERIES ESTABLISHED: Puerto Rico 1936.

REMARKS: Diagnostic horizons and features recognized in this pedon are:

Mollic epipedon - zone from 0 to 28 inches. (Ap, A, and Bssz1 horizons)

Vertic feature - Slickensides from 17 to 56 inches (Bssz and Bss horizons).

ADDITIONAL DATA: Characterization sample - S61PR121-001. Additonal samples - S61PR-14-1, S61PR-14-2, and S89PR-079-001. Samples by NSSL, Lincoln, NE.

MLRA: 273.

National Cooperative Soil Survey
U.S.A.

LOCATION FRATERNIDAD PR

Established Series
Rev. GRB
03/2000

FRATERNIDAD SERIES

The Fraternidad series consists of very deep, moderately well drained, slowly permeable soils on coastal plains. They formed in clayey sediments derived from volcanic rock and limestone. Near the type location, the mean annual temperature is about 77 degrees F., and the mean annual precipitation is about 35 inches. Slopes range from 0 to 12 percent.

TAXONOMIC CLASS: Fine, smectitic, isohyperthermic Typic Haplusterts

TYPICAL PEDON: Fraternidad clay. (Colors are for moist soil unless otherwise stated.)

Ap--0 to 6 inches; very dark grayish brown (10YR 3/2) clay; moderate fine granular structure; firm; slightly sticky and plastic; many fine roots; few siltstone pebbles less than 15 mm in diameter; slightly acid; abrupt smooth boundary. (4 to 7 inches thick)

ABss--6 to 12 inches; very dark grayish brown (10YR 3/2) clay; moderate coarse prismatic structure breaking to very weak coarse angular or wedge-shaped blocks; very hard, firm; plastic, slightly sticky; many fine roots; many large slickensides having polished and grooved surfaces; common siltstone pebbles 2 to 15 mm in diameter; few small soft black (10YR 2/1) bodies; slightly acid; clear wavy boundary. (40 to 50 inches thick)

BAss--12 to 24 inches; brown (10YR 4/3) clay with pockets of very dark grayish brown (10YR 3/2) clay; weak coarse angular or wedge-shaped peds breaking to small and medium angular peds; very hard, firm; plastic, slightly sticky; common fine roots; many large intersecting slickensides having polished and grooved surfaces; few small soft black (10YR 2/1) bodies; slightly effervescent, slightly alkaline; clear wavy boundary. (6 to 23 inches thick)

Bss--24 to 50 inches; brown (10YR 4/3) clay with pockets of sandy clay loam; large angular or wedge shaped intersecting peds; very hard, firm; plastic, slightly sticky; many large slickensides having polished and grooved surfaces; few to common small soft black (10YR 2/1) bodies; common fine and medium light gray (10YR 7/2) splotches of lime, strongly effervescent; moderately alkaline.

TYPE LOCATION: Lajas Valley, Puerto Rico. Approximately 690 feet north and 150 feet east of junction of road to poultry barns east of Lajas Experiment Station headquarters.

RANGE IN CHARACTERISTICS: Solum thickness is more than 60 inches. Reaction ranges from slightly acid to slightly alkaline in the A, Ap, and ABss horizons, and from slightly alkaline to moderately alkaline in the Bass and Bss horizons. When dry, this soil has cracks ranging from 0.5 to 3 inches in width extending to depths greater than 20 inches. In pasture this soil has pronounced gilgai relief. The typifying pedon is at the center of a microknoll.

The A, AP, and ABss horizons have moist values of 2 or 3. Texture is clay loam or clay.

The BAss horizon has hue of 10YR or 2.5Y, moist value of 3 through 5, and chroma of 2 through 4. Texture is clay.

The Bss horizon has hue of 10YR or 2.5Y, moist value of 4 or 5, and chroma of 3 through 6. Texture is clay.

COMPETING SERIES: The Santa Isabel series is the only known series in the same family. Santa Isabel soils are on similar positions but are not calcareous in any part.

GEOGRAPHIC SETTING: Fraternidad soils are on coastal plains. They formed in clayey sediments derived from volcanic rocks and limestone. The climate is tropical semiarid. Slopes range from 0 to 12 percent. The average annual temperature ranges from 76 to 78 degrees F., and the average annual precipitation ranges from 30 to 35 inches.

GEOGRAPHICALLY ASSOCIATED SOILS: Aguirre, Cartagena, Fe, Guanica, and Paso Seco soils. Aguirre, Cartagena, Fe, and Guanica soils are somewhat poorly drained. In addition, Aguirre soils are on lower positions, have more clay in the subsoil, and are sodic. Cartagena soils are on similar positions, have mixed mineralogy, and are sodic. Fe soils are on slightly higher positions, and are sodic. Guanica soils are on slightly lower positions and have more clay in the subsoils. The moderately well drained Paso Seco soils have a lithologic discontinuity with very gravelly loamy material

below depths of 28 to 35 inches.

DRAINAGE AND PERMEABILITY: Moderately well drained; slow permeability.

USE AND VEGETATION: Fraternidad soils are used for pasture and cultivated crops including sugarcane, rice, fruit, and vegetable crops. The vegetation consists of guineagrass, buffelgrass, and other native and introduced species.

DISTRIBUTION AND EXTENT: Coastal plains of southern Puerto Rico. The soils of this series are moderately extensive.

MLRA OFFICE RESPONSIBLE: Auburn, Alabama.

SERIES ESTABLISHED: Puerto Rico; 1936.

REMARKS: The classification was previously updated with the 4/91 draft from Fine, montmorillonitic, isohyperthermic Udic Chromusterts to Fine, montmorillonitic, isohyperthermic Typic Chromusterts. The present definition in Soil Taxonomy for Udic-ustic soil moisture regimes is mutually exclusive. The previous OSED date for this series was 7/84.

A gypsum substratum phase is recognized. Depth to gypsum is 30 to 40 inches. Electrical conductivity is 0 to 2 millimohs per centimeter in the A horizons, 2 to 4 millimohs per centimeter in the BAss horizon and in the upper part of the Bss horizon, and 8 to 16 millimohs per centimeter in the lower part of the Bss horizon. Depth to moderate salinity is 30 to 40 inches.

A gravelly substratum phase is also recognized. Depth to the gravelly layer is 20 to 36 inches.

Diagnostic horizons and features recognized in this pedon:

Mollic epipedon - zone from 0 to 11 inches (Ap and ABss horizons).

Slickensides and vertic features - zone from 6 to 50 inches (ABss, BAss and Bss horizons).

ADDITIONAL DATA: NSSL S61PR-14-9. Sample by NSSL, Lincoln, NE.

National Cooperative Soil Survey
U.S.A.

LOCATION GUANABANO PR

Established Series
Rev. REG
06/2002

GUANABANO SERIES

The Guanabano series have dark reddish brown, calcareous clay A horizons, dark reddish brown, calcareous plastic clay B horizons over reddish brown, calcareous clay, friable, clay C horizon.

TAXONOMIC CLASS: Fine, smectitic, isohyperthermic Calcidic Argiustolls

TYPICAL PEDON: Guanabano clay - hurricanegrass.
(Colors are for moist soil unless otherwise stated)

Ap--0 to 6 inches; dark reddish brown (5YR 3/2) clay; moderate medium granular structure; firm, slightly sticky, plastic; many fine roots; many very fine volcanic and limestone angular fragments; 15 percent by volume of volcanic and limestone cobbles in the surface; strong effervescence; clear smooth boundary. (5 to 8 inches (12-20 cm) thick)

B2t--6 to 11 inches; dark reddish brown (5YR 3/2) clay; moderate medium subangular blocky structure; firm, slightly sticky, plastic; many fine roots; few patchy clay films; many very fine volcanic and limestone fragments; few medium volcanic fragments; strong effervescence; clear smooth boundary. (4 to 8 inches (10-20 cm) thick)

B3ca--11 to 20 inches; reddish brown (5YR 4/3) silty clay loam; weak medium and coarse subangular blocky structure; firm, slightly sticky, plastic, common fine roots; accumulations of numerous fine soft calcium carbonate in spheres, coatings and mycelia shapes on faces of peds; many very fine volcanic fragments; few medium volcanic fragments; violent effervescence; clear wavy boundary. (7 to 12 inches (18-30 cm) thick)

C1--20 to 50 inches; reddish brown (5YR 5/3) silty clay loam; massive; firm, slightly sticky, plastic, violent effervescence;

clear wavy boundary.

C2--50 to 60 inches; reddish gray (5YR 5/2) gravelly silty clay loam; massive; slightly sticky, plastic, 50 percent by volume consists of subrounded and angular volcanic and limestone fragments.

TYPE LOCATION: Caribe SCD, Puerto Rico, 100 meters south of Ubarris' farm silo, southwest of kilometer marker 18.15, of Highway No. 14.

RANGE IN CHARACTERISTICS: Thickness of the solum ranges from 16 to 28 inches (41-72 cm). Depth to the semiconsolidated calcareous rock is over 4 feet (120 cm). Depth to calcic horizon ranges from 9 to 16 inches (23-41 cm). Amount of volcanic and limestone cobbles on the surface varies from 10 to 20 percent by volume. Colors of the A and B2t horizons are dark reddish brown (5YR 2/2, 3/2, 3/3). The lower B horizons are reddish brown (5YR 4/3, 4/4). Texture of the Bt is silty clay or clay. The B3ca and C horizons are silty clay loam. Clay films in the Bt horizons are patchy and few or common. Structure of the Bt horizon ranges from weak medium to moderate fine and medium subangular blocky inclusive. These soils are slightly sticky and plastic throughout the profile. Effervescence with dilute HC1 becomes more violent in the B3ca.

COMPETING SERIES: These are the Coamo, Isaac, Kramer, Parasol, and Yauco series. The Coamo soils have calcic horizons below 20 inches and are more clayey. The Isaac soils have hard rock within 20 to 36 inches (50-92 cm) of the soil surface. The Kramer soils have hard rock within 20 inches. The Parasol and Isaac soils are noncalcareous and lack calcic horizons within 50 inches. The Yauco soils lack argillic horizons.

GEOGRAPHIC SETTING: The Guanabana soils occur on steep sideslopes and hilltops with slope gradients of 40 to 60 percent. The soil formed in residuum weathered from calcareous volcanic rocks. The climate is semiarid. The annual precipitation ranges for 20 to 35 inches and the mean annual temperature ranges from 78 to 80 degrees F.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Callabo and Llanos soils. The Callabo soils occur in similar sideslopes, have brown colors, cambic horizons and are noncalcareous. The Llanos soils occur in adjacent footslopes and terraces. The Llanos soils are finer textured.

DRAINAGE AND PERMEABILITY: Well drained; very rapid runoff; moderate permeability.

USE AND VEGETATION: Mostly in guineagrass, pajon and hurricanegrass, and used as pasture or range.

DISTRIBUTION AND EXTENT: Semiarid uplands of Puerto Rico. The series is of minor extent.

MLRA OFFICE RESPONSIBLE: Auburn, Alabama

SERIES ESTABLISHED: Ponce Survey Area, Puerto Rico; l971.

REMARKS: The Guanabano soils were formerly included in the Descalabrado series and classified in the Lithosol great soil group.

National Cooperative Soil Survey
U.S.A.

LOCATION HUMATAS PR

Established Series
Rev. GRB
06/2002

HUMATAS SERIES

The Humatas series consists of very deep, moderately slowly permeable, well drained soils on side slopes and ridges of strongly dissected uplands. They formed in clayey and loamy material that weathered from igneous rocks. Near the type location, the mean annual precipitation is about 78 inches and the mean annual temperature is about 75 degrees F. Slopes range from 5 to 60 percent.

TAXONOMIC CLASS: Very-fine, parasesquic, isohyperthermic Typic Haplohumults

TYPICAL PEDON: Humatas clay - native pasture. (Colors are for moist conditions.)

Ap-- 0 to 4 inches; dark brown (7.5YR 4/4) clay; moderate fine granular structure; firm, slightly sticky, slightly plastic; many fine roots; very strongly acid; clear smooth boundary. (4 to 8 inches thick)

Bt1--4 to 9 inches; yellowish red (5YR 5/6) clay; moderate fine subangular blocky structure; few faint clay films on faces of peds; firm; slightly sticky, plastic; many fine roots; few fine vesicular and tubular pores; few fine black particles; very strongly acid; clear smooth boundary.

Bt2--9 to 15 inches; red (2.5YR 5/8) clay; moderate fine and medium subangular blocky structure; few faint clay films on faces of peds; firm; slightly sticky, plastic; common fine roots; few fine vesicular and tubular pores, very strongly acid; clear smooth boundary.

Bt3--15 to 25 inches; red (2.5YR 5/6) clay; weak fine subangular blocky structure; few faint clay films on faces of peds; firm; slightly sticky, slightly plastic; few fine roots; common fine vesicular and tubular pores; very strongly acid; clear

smooth boundary. (Total thickness of the Bt horizons ranges from 12 to 31 inches)

BC--25 to 32 inches; rubbed color red (2.5YR 5/6) silty clay loam; about 30 percent of this horizon consists of saprolite of variegated colors as: red (2.5YR 4/6), dark red (2.5YR 3/6), very pale brown (10YR 7/4), yellowish brown (10YR 5/8); weak fine and medium subangular blocky structure; friable; slightly sticky, slightly plastic; few fine roots; many fine vesicular and tubular pores; very strongly acid; clear smooth boundary. (6 to 12 inches thick)

C1--32 to 45 inches; about 25 percent red (2.5YR 4/6), about 25 percent dark red (2.5YR 3/6), about 25 percent very pale brown (10YR 7/4), and about 25 percent yellowish brown (10YR 5/8), rubbed color is red (2.5YR 4/6); silty clay loam; massive; friable, nonsticky, slightly plastic; many fine pores; very strongly acid; clear smooth boundary.

C2--45 to 60 inches; about 25 percent red (2.5YR 4/6), about 25 percent dark red (2.5YR 3/6), about 25 percent very pale brown (10YR 7/4), and about 25 percent yellowish brown (10YR 5/8), rubbed color is red (2.5YR 4/6); saprolite that has a silty clay loam texture; massive; friable, nonsticky and slightly plastic; very strongly acid.

C3--60 to 96 inches; about 25 percent red (2.5YR 4/6), about 25 percent dark red (2.5YR 3/6), about 25 percent very pale brown (10YR 7/4), and about 25 percent yellowish brown (10YR 5/8), rubbed color is red (2.5YR 4/6) saprolite that has a clay loam texture; massive; very friable, nonsticky, slightly plastic; very strongly acid.

TYPE LOCATION: Oeste SCD, Puerto Rico. Approximately 6.5 miles northeast of the city of Mayaguez; about 660 feet on dirt road from kilometer marker 2.45 on Highway 406, and about 350 feet southwest of dirt road.

RANGE IN CHARACTERISTICS: Thickness of the solum ranges from 22 to 51 inches. Reaction is very strongly acid or strongly acid. Rock fragments range from 0 to 20 percent, by volume throughout, except for the A horizon which can range to 40 percent by volume.

The A horizon has hue of 5YR to 10YR, value of 3 to 5, and chroma of 3 to 6. Texture is silty clay loam, silty clay, clay, or their gravelly analogs.

The Bt horizon has hue of 10R to 10YR, value of 4 to 6, and chroma of 4 to 8. Texture is silty clay, clay, or their gravelly analogs.

The BC horizon has hue of 10R to 10YR, value of 4 to 6, and chroma of 4 to 8; or there is no dominant matrix color and are multicolored in shades of red, yellow, brown and gray. Texture is silty clay loam, silty clay, clay, or their gravelly analogs.

The C horizons has hue of 10R to 10YR, value of 4 to 6, and chroma of 4 to 8. Texture is silty clay loam, clay loam, clay, or their gravelly analogs.

COMPETING SERIES: There are no other known series in the same family.

GEOGRAPHIC SETTING: Humatas soils are on side slopes and ridges of uplands. They formed in fine-textured residuum weathered from basic igneous rock. The climate is humid tropical. Slopes range from 5 to 60 percent. The average annual precipitation ranges from 70 to 86 inches and the average annual temperature ranges from 74 to 76 degrees F.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Alonso, Consumo, Daguey, Lares, Los Guineos, and Zarzal soils. Alonso soils have oxidic control sections. Consumo soils are moderately deep to saprolite. Daguey soils have more clay in the control section and are Oxisols. The somewhat poorly drained Lares soils are on terraces at lower elevations. Los Guineos soils are on higher positions, are isothermic, have more clay in the control section, and are Oxisols. Zarzal soils have more clay in the control section and are Oxisols.

DRAINAGE AND PERMEABILITY: Well drained; moderately slowly permeability.

USE AND VEGETATION: Most areas of Humatas soils are used for pasture, food crops, and coffee production. Vegetation consists of native and introduced upland species.

DISTRIBUTION AND EXTENT: Humid uplands of Puerto Rico. The series is of large extent.

MLRA OFFICE RESPONSIBLE: Auburn, Alabama.

SERIES ESTABLISHED: Humacao Survey Area, Puerto Rico; 1968.

REMARKS: Diagnostic horizons and features recognized in this pedon:

Ochric epipedon - zone from 0 to 4 inches (Ap horizon).

Argillic horizon - zone from 4 to 25 inches (Bt horizons).

ADDITIONAL DATA: Characterization data are available for the typical pedon S61PR-8-1 and pedon S61PR-8-4, both are published in Soil Survey Investigation Report No. 12. Samples by NSSL, Lincoln, NE.

MLRA: 270.

National Cooperative Soil Survey
U.S.A.

LOCATION JACAGUAS PR

Established Series
Rev. REG
08/2000

JACAGUAS SERIES

The Jacaguas series is a well to excessively drained, moderately permeable soils on flood plains. These soils have very dark brown, clay loam, granular A horizons and very dark grayish brown, gravelly clay loam B horizons over very gravelly and cobbly layers.

TAXONOMIC CLASS: Loamy-skeletal, mixed, superactive, isohyperthermic Fluventic Haplustolls

TYPICAL PEDON: Jacaguas clay loam - sugarcane.
(Colors are for moist soil unless otherwise stated.)

Ap--0 to 8 inches; very dark brown (10YR 2/2) clay loam; moderate medium granular structure; friable, slightly sticky, slightly plastic; many fine roots; mildly alkaline, clear smooth boundary. (4 to 12 inches thick)

B2--8 to 16 inches; very dark grayish brown (10YR 3/2) gravelly clay loam, dark yellowish brown (10YR 3/4) crushed; weak medium subangular blocky structure; firm, slightly sticky, slightly plastic; few fine roots; more than 35 percent by volume of gravels and cobbles; mildly alkaline; clear smooth boundary. (4 to 12 inches thick)

IIC--16 to 40 inches; dark yellowish brown (10YR 3/4) very cobbly loam with more than 75 percent by volume of rounded and subrounded volcanic rock fragments of various sizes and shapes, but mostly ranging from 3 to 10 inches in diameter.

TYPE LOCATION: Caribe SCD, Puerto Rico, 5.0 miles southwest of town of Juana Diaz, at the Fortuna Experiment Substation Farm, 275 meters southwest of the main entrance to the farm.

RANGE IN CHARACTERISTICS: Thickness of the solum ranges from 8 to 20 inches. Depth to the IIC horizon does not exceed 20 inches, but the norm for the series ranges from 12 to 20 inches. Gravels and cobbles may be found anywhere in the profile but exceeds 35 percent by volume in the 10 to 40 inch control section. These soils have a slightly sticky and slightly plastic sola. The soil is neutral or mildly alkaline. Mean annual soil temperature at 20 inches ranges from 72 to 74 degrees F.

Colors of the A horizon have hues of 10YR, values of 2 or 3, and chromas of 2 or 3. The A horizon is silty clay loam, loam, or clay loam.

Color of the B horizon is in hues of 10YR, values of 3 or 4, and chromas of 2, 3, or 4. The B horizon is gravelly loam, gravelly clay loam, or gravelly silty clay loam. Structure of the B horizon ranges from weak fine to weak medium subangular blocky.

COMPETING SERIES: These are the Cortada, Cuyon, and San Anton series. Cortada and San Anton soils lack the gravelly and cobbly underlying horizons and are thicker soils. Cuyon soils are thinner, coarser, textured, and lack cambic horizons.

GEOGRAPHIC SETTING: The Jacaguas soils occur on nearly level to gently sloping flood plains close to the stream channel in the southern coastal plains of Puerto Rico. Slope gradients range from 0 to 5 percent. The soil formed in moderately fine textured stratified sediments derived from limestone and volcanic rocks. The climate is tropical semiarid with mean annual precipitation of 37 inches. The mean annual temperature is 79 degrees F.

GEOGRAPHICALLY ASSOCIATED SOILS: These include the competing Cortada, Cuyon, and San Anton series, and Constancia, Machuelo, and Vayas series. The Constancia, Machuelo, and Vayas soils are thicker and more poorly drained.

DRAINAGE AND PERMEABILITY: Well to excessively well drained; runoff slow. Permeability is moderate in the solum and very rapid in the underlying gravelly and cobbly layers.

USE AND VEGETATION: Most areas are in sugarcane where irrigation is available. Areas not irrigated are in native grasses and used for pasture.

DISTRIBUTION AND EXTENT: Southern coastal plains of Puerto Rico. The series is of minor extent.

MLRA OFFICE RESPONSIBLE: Auburn, Alabama

SERIES ESTABLISHED: Puerto Rico; 1971.

National Cooperative Soil Survey
U. S. A.

LOCATION JACANA PR

Established Series
Rev. BCD
01/2001

JACANA SERIES

The Jacana series consists of moderately deep, well drained, moderately slowly permeable soils formed in material weathered from volcanic rock. These gently sloping to moderately steep soils are on fans, foot slopes and low hills. Slopes range from 2 to 20 percent. The mean annual precipitation is about 35 inches and the mean annual temperature is about 79 degrees F.

TAXONOMIC CLASS: Fine, mixed, superactive, isohyperthermic Vertic Haplustolls

TYPICAL PEDON: Jacana clay--cultivated. (Colors are for moist soil unless otherwise stated.)

Ap--0 to 6 inches; very dark brown (10YR 2/2) clay; moderate fine granular structure; hard, friable, slightly sticky, plastic; common fine roots; medium acid; clear smooth boundary. (4 to 8 inches thick)

A--6 to 13 inches; very dark brown (10YR 2/2) clay; weak coarse subangular blocky structure; hard, firm, slightly sticky, plastic; few fine roots; few pressure faces and small slickensides; medium acid; clear wavy boundary. (3 to 9 inches thick)

Bss--13 to 21 inches; dark brown (7.5YR 3/2) clay; streaks of very dark brown (10YR 2/2) from overlying horizon; weak coarse blocky structure; hard, firm, slightly sticky, plastic; few fine roots; many small pressure faces and slickensides; cracks to 21 inches; neutral; clear wavy boundary. (6 to 10 inches thick)

C/B--21 to 28 inches; 80 percent saprolite from volcanic rock and 20 percent by volume dark brown (7.5YR 3/2) clay in pockets and seams; clay loam; massive; friable slightly sticky, slightly plastic; neutral; gradual wavy boundary. (6 to 10 inches thick)

Cr--29 to 40 inches; highly weathered, semi-consolidated bedded, volcanic rock.

TYPE LOCATION: Lajas Valley, Puerto Rico; 60 feet east of kilometer marker 1.7 of Highway 117, and 35 feet south of fence along highway.

RANGE IN CHARACTERISTICS: Depth to semiconsolidated rock ranges from 20 to 40 inches. Reaction ranges from medium acid to mildly alkaline.

The A horizons have hue of 10YR or 7.5YR, and value and chroma of 2 or 3. Texture is clay loam or clay.

The Bss horizon has hue of 10YR or 7.5YR and value and chroma of 2 through 4.

The Cr horizon consists of highly weathered, semi-consolidated bedded volcanic rock. In places, secondary lime occurs as coatings along cleavage planes.

COMPETING SERIES: There are no other series in this family.

GEOGRAPHIC SETTING: The Jacana soils are on fans foot slopes and low hills. Slope is 2 to 20 percent. These soils formed in material weathered from volcanic rock. The climate is tropical semiarid. The mean annual precipitation is 30 to 40 inches and mean annual temperature is 78 to 80 degrees F.

GEOGRAPHICALLY ASSOCIATED SOILS: There are the Callabo, Coamo, Descalabrado, Fraternidad, Juana Diaz, Llanos, and San German soils. Callabo soils do not have vertic properties. Coamo soils have an argillic horizon and do not have bedrock within a depth of 40 inches. Descalabrado, Juana Diaz, and San German soils have bedrock at depths less than 20 inches. Fraternidad and Llanos soils do not have bedrock within a depth of 40 inches.

DRAINAGE AND PERMEABILITY: Well drained; medium runoff; moderately slow permeability.

USE AND VEGETATION: Most areas are used for pasture. The main pasture species are Guineagrass and buffelgrass. Some areas are used for crops including tomatoes, peppers, pigeon peas, and mangos.

DISTRIBUTION AND EXTENT: Semiarid areas of Puerto Rico and the U.S. Virgin Islands. The soils of this series are of moderate extent.

MLRA OFFICE RESPONSIBLE: Auburn, Alabama

SERIES ESTABLISHED: Puerto Rico; 1936.

REMARKS: The classification was updated with the 4/91 draft from Fine, mixed, isohyperthermic Udertic Haplustolls to Fine, mixed, isohyperthermic Vertic Haplustolls. It is presently impossible to have a Udic-ustic soil moisture regime in the tropics. The previous OSED date was 11/84.

Prior to 1984 this soil was classified as a fine, mixed, isohyperthermic Vertic Ustropept.

Diagnostic horizons and features recognized in this soil:

Mollic epipedon - zone from 0 to 13 inches (Ap and A horizons)

Vertic properties - pressure faces and slickensides in A and Bss horizons.

ADDITIONAL DATA: Sampled as S61PR-14-4.

National Cooperative Soil Survey
U.S.A.

LOCATION JUANA DIAZ PR

Established Series
Rev. GA-BCD-JD
06/2002

JUANA DIAZ SERIES

The Juana Diaz series consists of shallow, well drained, moderately permeable soils formed in residuum weathered from sandstone. They are on rounded hilltops and sideslopes of uplands. Slopes ranges from 20 to 40 percent. The mean annual precipitation is about 33 inches and the mean annual temperature is about 79 degrees F.

TAXONOMIC CLASS: Loamy, mixed, superactive, isohyperthermic, shallow Typic Haplustepts

TYPICAL PEDON: Juana Diaz clay loam - rangeland. (Colors are for moist soil unless otherwise stated.)

Ap--0 to 6 inches; dark yellowish brown (10YR 3/4) 80 percent, dark brown (10YR 4/3) 20 percent, (0-15 cm) clay loam; moderate fine and medium granular structure; firm, slightly sticky, plastic; many fine roots; neutral; abrupt smooth boundary. (5 to 7 inches thick)

Bw--6 to 12 inches; dark yellowish brown (10YR 4/4) clay loam, weak medium and coarse subangular (15-30 cm) blocky structure; firm, slightly sticky, plastic; common fine roots; neutral; clear smooth boundary. (5 to 7 inches thick)

BC--12 to 18 inches; yellowish brown (10YR 5/6) silt loam; weak medium subangular blocky structure; (30-45 cm) friable, slightly sticky, slightly plastic; few fine roots; 15 percent by volume of saprolite; mildly alkaline; clear smooth boundary. (4 to 6 inches thick)

Cr--18 to 40 inches; consists of semi-consolidated sandstone that can be easily broken with the spade.

TYPE LOCATION: Caribe SCD, Puerto Rico; 80 feet south of kilometer marker 15.75 of Highway 14.

RANGE IN CHARACTERISTICS: Thickness of the solum and depth to the sandstone ranges from 14 to 20 inches. Reaction ranges from slightly acid to mildly alkaline. Rock fragments range from 0 to 35 percent.

The A horizon has hue of 10YR, value of 3 or 4, and chroma of 3 or 4. Texture is clay loam. Consistence is slightly sticky and plastic.

The Bw horizons hue of 10YR, value of 4 or 5 and chroma of 4 or 6. Texture is silt loam, clay loam or loam, and never exceed 35 percent in clay. Structure ranges from weak medium to weak fine subangular blocky. Consistence is sliightly sticky and plastic in the upper B horizons, and friable in the lower B horizons.

The BC horizon has similar color and texture as the Bw horizon. Saprolite ranges from 10 to 40 percent.

The Cr horizon is semi-consolidated sandstone.

COMPETING SERIES: These are the Callabo, Victory, and Vieques series in the same subgroup, and the Diamond, Pandura, Sabana, and Yunes series. The Callabo soils are finer textured. The Victory soils are thicker. The Vieques soils are coarser textured, and have coarse fragments. The Diamond soils have hard limestone within 20 inches and colors of soil are in redder hues. Pandura soils have a thinner, coarser textured solum. Sabana soils have hard volcanic rock within 20 inches and solum is more acid. Yunes soils have coarse fragments throughout the solum and the soil is more acid.

GEOGRAPHIC SETTING: The Juana Diaz soils occur on moderately to steeply sloping rounded hilltops and sideslopes with slope gradients from 20 to 40 percent. The soil formed in loamy residuum weathered from sandstone. The climate is semiarid. Average annual precipitation ranges from 25 to 40 inches. Mean annual temperature is 80 degrees F. The range in mean annual soil temperature is from 78 to 80 degrees F.

GEOGRAPHICALLY ASSOCIATED SOILS: There are no associated soils.

DRAINAGE AND PERMEABILITY: Well drained; medium runoff; moderate permeability.

USE AND VEGETATION: Most of the acreage is in rangeland or pasture.

DISTRIBUTION AND EXTENT: Semiarid sections of Puerto Rico. The series is of small extent.

MLRA OFFICE RESPONSIBLE: Auburn, Alabama

SERIES ESTABLISHED: Puerto Rico; l936.

REMARKS: Diagnostic horizons and features recognized in this pedon:

Ochric epipedon - zone from 0 to 6 inches (A horizon)

Cambic horizon - zone from 6 to 18 inches (Bw and BC horizons)

Paralithic contact - zone at 18 inches (Cr layer)

This series was formerly classified in Reddish Chestnut great soil group.

National Cooperative Soil Survey
U.S.A.
LOCATION LARES PR

Established Series
Rev. BCD
06/2002

LARES SERIES

The Lares series consists of very deep, somewhat poorly drained, moderately slowly permeable soils on dissected terraces. They formed in transported volcanic rocks. Slopes range from 2 to 20 percent. The mean annual precipitation is about 80 inches and the mean annual temperature is about 78 degrees F.

TAXONOMIC CLASS: Very-fine, mixed, semiactive, isohyperthermic Aquic Paleudults

TYPICAL PEDON: Lares silty clay - sugar cane. (Colors are for moist soil unless otherwise stated.)

Ap--0 to 9 inches; brown (10YR 4/3) silty clay; weak fine granular structure; slightly hard, friable, slightly sticky, slightly plastic; common fine roots; very strongly acid; clear smooth boundary. (5 to 10 inches thick)

Bt1--9 to 14 inches; light yellowish brown (10YR 6/4) and grayish brown (10YR 5/2) clay; weak medium subangular blocky structure; friable, slightly sticky, plastic; few faint clay films; common fine roots; few fine concretions; very strongly acid; clear smooth boundary. (4 to 7 inches thick)

Bt2--14 to 20 inches; light yellowish brown (10YR 6/4) clay with few fine prominent dark red (10YR 3/6), common fine faint very pale brown (10YR 7/3), and few fine faint yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; firm, slightly sticky, plastic; many prominent clay films; few fine roots; common fine and medium partially weathered angular rock fragments; strongly acid; clear smooth boundary. (5 to 8 inches thick)

BC1--20 to 29 inches; yellowish brown (10YR 5/6) clay with few fine prominent dark red (10YR 3/6), few fine prominent red (10YR 4/8), and few fine faint light gray (10YR 7/2) mottles; weak fine and medium subangular blocky structure; firm, slightly sticky, plastic; few fine roots; many weathered rock fragments; few hard slightly weathered angular rock fragments; very strongly acid; gradual smooth boundary. (8 to 10 inches thick)

BC2--29 to 45 inches; mixed yellowish brown (10YR 5/6), greenish gray (5GY 6/1) and yellowish brown (10YR 5/6) clay; yellowish brown (10YR 5/6) when crushed; weak coarse subangular blocky structure; firm, slightly sticky, plastic; very strongly acid; gradual smooth boundary. (12 to 18 inches thick)

C--45 to 71 inches; weathered rock fragments of variegated colors as yellowish brown (10YR 5/6), red (10YR 4/6), and greenish gray (5GY 6/1) clay; massive; friable, slightly sticky, slightly plastic; common fine hard rock fragments; very strongly acid.

TYPE LOCATION: Oeste SCD, Puerto Rico. One mile northwest of the town of Anasco. Three hundred feet southeast of kilometer marker 143.6 of highway 2.

RANGE IN CHARACTERISTICS: Thickness of the solum ranges from 34 to 53 inches. Thickness of the argillic horizon does not exceed 43 inches.

The A horizon is in hues of 7.5YR or 10YR, values of 4 and chromas of 3 or 4. Texture is silty clay loam, silty clay or clay. These soils have slightly sticky and slightly plastic A horizons. They are strongly or very strongly acid.

The Bt horizon has hue of 10YR, 7.5YR, or 5YR, value of 4, 5, or 6 an chroma of 4 and higher. They have red, yellow and brown mottles. Depth to mottles with chromas of 2 or less range from 18 to 30 inches of the soil surface. Clay films range from few faint to many prominent. Texture is clay and silty clay. Structure range from moderate to strong and from fine to medium. Wet consistence is slightly sticky and plastic. They are strongly or very strongly acid. Organic carbon content ranges from 1.0 to 1.4 percent in the upper 6 inches of the argillic horizon.

The mean annual soil temperature ranges from 75 to 78 degrees F.

COMPETING SERIES: These are the Naranjito and Picacho series in the same subgroup and Corozal, Daguao, and Los Guineos series. Daguao, Los Guineos, and Naranjito soils lack low chromas mottles in their profiles. In addition, Los Guineos soils are cooler and have yellower colors in the upper argillic horizon. The Corozal soils have less organic matter and have low chroma mottles immediately below the A horizons. Picacho soils have cooler soil temperatures.

GEOGRAPHIC SETTING: The Lares soils occur on gently to moderately sloping dissected terraces on slope

gradients from 2 to 20 percent. The soil formed in fine textured material in transported volcanic rocks. The climate is humid tropical. The average annual precipitation is 80 inches and the mean annual temperature is 78 degrees F.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Daguey, Humatas, and Consumo series. These soils occur on steeper slopes, have colors of redder hues and lack low chroma mottles in the argillic horizon.

DRAINAGE AND PERMEABILITY: Somewhat poorly drained; medium to slow runoff; moderately slow permeability.

USE AND VEGETATION: Most of the acreage is in sugar cane.

DISTRIBUTION AND EXTENT: Humid valleys of Puerto Rico. The series is of minor extent.

MLRA OFFICE RESPONSIBLE: Auburn, Alabama

SERIES ESTABLISHED: Puerto Rico; l936.

REMARKS: The classification was updated with the 4/91 draft from Clayey, mixed, isohyperthermic Aquic Tropudults to Clayey, mixed, isohyperthermic Aquic Hapludults. The previous OSED date was 6/71.

Diagnostic horizons and features recognized in this pedon:

Ochric epipedon - zone from 0 to 9 inches (Ap horizon)

Argillic horizon - zone from 9 to 20 inches (Bt horizons)

Aquic feature - 2 chroma mottles in Bt1 horizon

National Cooperative Soil Survey
U.S.A.

LOCATION LIRIOS PR

Established Series
Rev. BCD
08/2000

LIRIOS SERIES

The Lirios series consists of very deep, well drained, moderately permeable soils formed in materials weathered from Plutonic age. They are steep to very steep soils on side slopes and ridgetops of strongly dissected uplands. Slopes range from 3 to 60 percent. The mean annual precipitation is about 80 inches and the mean annual temperature is about 78 degrees F.

TAXONOMIC CLASS: Fine, mixed, subactive, isohyperthermic Typic Hapludults

TYPICAL PEDON: Lirios silty clay loam - cultivated. (Colors are for moist soil.)

Ap--0 to 4 inches; dark brown (10YR 4/3) silty clay loam; weak fine subangular blocky structure; friable, nonsticky, slightly plastic; many fine roots; many fine quartz crystals; common fine dark concretions; very strongly acid; abrupt smooth boundary. (4 to 8 inches thick)

Bt1--4 to 14 inches; red (2.5YR 4/8) clay; weak medium subangular blocky structure; friable, slightly sticky, slightly plastic; common fine roots; few faint clay films on surfaces of peds and root channels; common fine quartz crystals; few fine white flakes; very strongly acid; gradual smooth boundary. (8 to 12 inches thick)

Bt2--14 to 23 inches; red (10R 4/6) silty clay with common fine distinct reddish yellow (5YR 6/6) mottles; weak fine subangular blocky structure; friable, slightly sticky, slightly plastic; few fine roots; few faint clay films on surfaces of peds; common fine quartz crystals; many fine shiny white flakes; very strongly acid; gradual smooth boundary. (8 to 14 inches thick)

C--23 to 60 inches; variegated colors; red (10R 4/6), strong brown (7.5YR 5/8), reddish brown (5Y 4/3), pink (5YR 7/3); silty clay loam; massive; friable, nonsticky, slightly plastic; many fine quartz crystals; many fine shiny flakes; very strongly acid. This horizon consists of saprolite.

TYPE LOCATION: Este SCD, Puerto Rico, Barrio Guayabota, Municipality of Yabucoa; 150 feet south of kilometer marker 11.9 on Highway 181. Photo GS-LR 9-25.

RANGE IN CHARACTERISTICS: Solum thickness ranges from 20 to 34 inches. Thickness of the argillic horizon varies from 16 to 26 inches. They are strongly or very strongly acid throughout. Quartz crystals vary from none to many. Base saturation by sum of cation ranges from 10 to 18 percent. Organic carbon content in the upper 6 inches of the argillic horizon varies from 0.6 to 0.9 percent. The mean annual soil temperature ranges from 76 to 78 degrees F.

The A horizon has hue of 5YR to 10YR, value of 4 and chroma of 3 or 4. Texture is silty clay loam or clay loam and is nonsticky and slightly plastic.

The Bt horizon has hue of 5YR to 10R, value of 4 or 5, and chroma of 6 and higher. It is clay or silty clay and consistence is slightly sticky and slightly plastic, clay films vary from few faint to many prominent.

The BC horizon, where present, has hue of 2.5YR or 10R with reddish yellow, yellowish brown or brownish yellow mottles.

The C horizons are silty clay loam, loam, or silt loam.

COMPETING SERIES: There are no other known series in the same family. The Consumo, Consojo, Corozal, Corozo, Ingenio, Jagueyes, Maricao, Moca, Patillas and Rio Piedras series are similar soils in related families. The Consumo, Maricao and Patillas soils have argillic horizons thinner than 16 inches. The Consejo soils are yellower and finer textured throughout. The Corozal soils are wetter and have low chroma mottles in the upper B horizons. The Corozo soils have sandy surface layers. The Ingenio and Jagueyes soils have lower CEC values, less than 24 meq/100 grams of clay.

GEOGRAPHIC SETTING: The Lirios soils are gently sloping to very steep soils on side slopes and narrow ridgetops. Slope ranges from 3 to 60 percent. The soil formed in fine over mucky-fine textured, very highly weathered residuum

weathered from plutonic rocks, mainly granodiorite or quartz diorite. The climate is humid tropical. The average annual precipitation ranges from 70 to 90 inches and the mean annual temperature ranges from 76 to 80 degrees F.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the competing Ingenio soils in addition to the Pandura and Pellejas soils. The Pandura soils occur in similar positions but are shallow to less weathered plutonic rock. The Pellejas soils are thinner, coarser textured and lack argillic horizons.

DRAINAGE AND PERMEABILITY: Well drained; medium to rapid runoff; moderate permeability.

USE AND VEGETATION: Original vegetation consists of native grasses and shrubs. The soils are used for pasture and food crops.

DISTRIBUTION AND EXTENT: Plutonic uplands. The series is of minor extent, about 28,000 acres.

MLRA OFFICE RESPONSIBLE: Auburn, Alabama

SERIES ESTABLISHED: Humacao Area, Puerto Rico; 1968.

REMARKS: The classification was updated with the 4/91 draft from Clayey over loamy, mixed, isohyperthermic Typic Tropudults to Clayey, mixed, isohyperthermic Typic Hapludults. The previous OSED date was 7/85.

The diagnostic horizons and features recognized in this pedon:

Ochric epipedon - zone from 0 to 4 inches (Ap horizon)

Argillic horizon - zone from 4 to 23 inches (Bt horizons)

National Cooperative Soil Survey
U.S.A.

LOCATION LLANOS PR

Established Series
Rev. REG
06/2002

LLANOS SERIES

The Llanos series consists of very dark brown or black, clay, plastic, neutral A horizons that become hard when dry and brown, clay, plastic B horizons over loamy stratified C horizons.

TAXONOMIC CLASS: Fine, smectitic, isohyperthermic Entic Haplusterts

TYPICAL PEDON: Llanos clay - native pasture.
(Colors are for moist soil unless otherwise stated.)

A11--0 to 5 inches; very dark brown (10YR 2/2) clay; moderate fine and medium granular structure; firm, hard when dry, slightly sticky, plastic; many fine roots; neutral; clear smooth boundary. (4 to 6 inches thick)

A12--5 to 10 inches; black (10YR 2/1) clay; weak medium subangular blocky structure; firm; hard when dry; slightly sticky, plastic; many fine roots; neutral; clear smooth boundary. (4 to 6 inches thick)

B1--10 to 15 inches; very dark brown (10YR 2/2) and black (10YR 2/1) clay; weak course subangular blocky structure; very firm, sticky, plastic; few fine roots; many pressure faces; 10 percent by volume of fine and very fine volcanic fragments; few patchy clay films; neutral; clear smooth boundary. (4 to 6 inches thick)

B2t--15 to 23 inches; dark brown (10YR 4/3) clay; moderate coarse subangular blocky structure; very firm, sticky, plastic; few fine roots; many pressure faces; 5 percent by volume of very fine volcanic fragments; few patchy clay films; neutral; clear wavy boundary. (6 to 10 inches thick)

B3--23 to 29 inches; dark brown (10YR 4/3) clay; weak medium subangular blocky structure; firm; slightly sticky, plastic; few fine roots; 10 percent by volume of fine gravel; neutral; cracks to 29 inches; clear wavy boundary. (5 to 8 inches thick)

C1--29 to 38 inches; dark brown (10YR 4/3) clay loam; massive; firm, slightly sticky, plastic; 10 percent by volume of fine gravel, mildly alkaline; gradual wavy boundary. (6 to 10 inches thick)

C2--38 to 50 inches; dark brown (10YR 4/3) sandy clay loam; massive, friable, nonsticky, slightly plastic; 10 percent by volume of fine gravel, mildly alkaline; gradual wavy boundary. (8 to 14 inches thick)

11C3--50 to 60 inches; dark brown (10YR 4/3) sandy loam; single grained; friable, nonsticky, non (125-150 cm) plastic; mildly alkaline.

TYPE LOCATION: Caribe SCD, Puerto Rico, 250 meters south of kilometer marker 15.8 of Highway 150.

RANGE IN CHARACTERISTICS: Thickness of the solum ranges from 23 to 36 inches.

The A horizons are black (10YR 2/1), very dark brown (10YR 2/2), or very dark grayish brown (10YR 3/2). The B2t horizons are dark grayish brown (10YR 4/2) or dark brown (10YR 4/3). The A and B horizons are dominantly clay.

The B horizons range from weak medium and coarse subangular blocky to moderate medium subangular blocky structure inclusive. These soils have slightly sticky and plastic A and B horizons.

The upper C horizons are clay loam or sandy clay loam. The lower C horizons are loamy sand or sandy loam. The coarse textured subhorizons are friable and nonsticky. The soil is neutral or mildly alkaline. The cracks are more than 1 centimeter wide and more than 30 cm long.

COMPETING SERIES: These include the Callabo, Jacana, Maguayo, and Montegrande series. The Callabo soils are shallower with a paralithic contact within 36 inches (92 cm). The Jacana soils have semiconsolidated rock within 40 inches and the Maguayo soils have a calcic horizon within 40 inches. The Montegrande soils occur in the humid regions and have soil moisture regimes that are not as dry.

GEOGRAPHIC SETTING: The Llanos soils occur on gently to moderately sloping footslopes and alluvial fans with slope gradients of 2 to 12 percent. The soil formed in fine and moderately fine textured sediments weathered from basic volcanic rocks. The climate is semiarid. The average annual rainfall ranges from 25 to 45 inches and the mean annual temperature is 78 to 80 degrees F.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Callabo and Jacana series.

DRAINAGE AND PERMEABILITY: Well drained; medium runoff; moderately slow permeability.

USE AND VEGETATION: Used for native pasture, cut grasses, tobacco, and subsistence crops.

DISTRIBUTION AND EXTENT: Semiarid section of Puerto Rico. The series is of minor extent.

MLRA OFFICE RESPONSIBLE: Auburn, Alabama

SERIES ESTABLISHED: Ponce Survey Area, Puerto Rico; l971.

REMARKS: These soils were formerly classified in the Chernozem great soil group.

National Cooperative Soil Survey
U.S.A.

LOCATION LOS GUINEOS PR

Established Series
BCD-HRM. Rev. GRB
07/2001

LOS GUINEOS SERIES

The Los Guineos series consists of very deep, well drained soils on side slopes of mountains. They formed in residuum from sandstone material. The mean annual precipitation is about 120 inches and the mean annual temperature is about 68 degrees F. Slopes range from 5 to 60 percent.

TAXONOMIC CLASS: Very-fine, kaolinitic, isothermic Humic Hapludox

TYPICAL PEDON: Los Guineos clay - forest. (Colors are for moist conditions.)

A--0 to 1 inch; dark yellowish brown (10YR 4/4) clay; moderate medium granular structure parting to moderate fine granular; firm; sticky, plastic; common very fine roots, many fine roots; few fine discontinuous tubular pores; many faint organic coats on vertical and horizontal faces of peds; extremely acid; clear smooth boundary. (1 to 5 inches thick).

Bt1--1 to 3 inches; yellowish brown (10YR 5/4) clay; moderate fine subangular blocky structure; firm; very sticky, very plastic; very few coarse, common fine and medium roots throughout; common very fine discontinuous tubular pores; few faint clay films on vertical and horizontal faces of peds; few worm casts; extremely acid; clear smooth boundary.

Bt2--3 to 9 inches; yellowish brown (10YR 5/6) clay; moderate medium subangular blocky structure parting to moderate coarse subangular blocky; firm; very sticky, very plastic; common fine and medium roots; common fine and medium discontinuous tubular pores; many distinct clay films on vertical and horizontal faces of peds; few worm casts; extremely acid; clear smooth boundary.

Bt3--9 to 18 inches; brownish yellow (10YR 6/6) clay; moderate coarse subangular blocky structure; firm; very sticky,

very plastic; common fine and medium roots; few fine discontinuous tubular pores; many distinct clay films on vertical and horizontal faces of peds; few worm casts; common fine distinct red (2.5YR 4/6) masses of iron accumulation; extremely acid; clear wavy boundary.

Bt4--18 to 31 inches; red (2.5YR 4/6) clay; moderate coarse subangular blocky structure parting to moderate medium subangular blocky; firm; very sticky, very plastic; few fine roots; few medium discontinuous tubular pores; many distinct clay films on vertical and horizontal faces of peds; few worm casts; many coarse distinct yellowish brown (10YR 5/6) masses of iron accumulation; very strongly acid; gradual smooth boundary. (Combined thickness of the Bt horizons range from 25 to 50 inches)

Bw1--31 to 43 inches; red (2.5YR 4/6) clay; weak coarse subangular blocky structure; firm; very sticky; very plastic; few fine roots; few medium discontinuous tubular pores; common distinct films on vertical faces of peds; common medium distinct yellowish brown (10YR 5/6) masses of iron accumulation; very strongly acid; gradual smooth boundary.

Bw2--43 to 61 inches; strong brown (7.5YR 5/6) clay; weak very coarse subangular blocky structure; firm; sticky, plastic; few fine roots; few medium discontinuous tubular pores; common faint films on vertical faces of peds; many medium distinct yellowish red (5YR 4/6) and few medium distinct yellowish brown (10YR 5/6) masses of iron accumulation; very strongly acid; clear smooth boundary.

Bw3--61 to 74 inches; strong brown (7.5YR 5/6) clay; weak very coarse subangular blocky structure; firm; sticky, plastic; few medium discontinuous tubular pores; common distinct coatings in root channels and/or pores; about 10 percent, by volume, saprolite; many medium distinct yellowish red (5YR 4/6) masses of iron accumulation; very strongly acid; gradual smooth boundary.

Bw4--74 to 93 inches; yellowish red (5YR 4/6) clay; weak very coarse subangular blocky structure; firm; sticky, plastic; few medium discontinuous tubular pores; about 10 percent, by volume, saprolite; very strongly acid. (Thickness of the Bw horizon is 50 to 80 inches).

TYPE LOCATION: Rio Grande Municipio, Noreste SWCD; Caribbean National Forest, Puerto Rico. Approximately 150 feet southwest of bridge on Road 911. El Yunque topographic quadrangle; lat. 18 degrees 18 minutes 47 seconds N.; long. 65 degrees 49 minutes 27 seconds W.; PRD 1940.

RANGE IN CHARACTERISTICS: Solum thickness and depth to bedrock is more than 80 inches. Rock fragments range from 0 to 10 percent, by volume, throughout the profile. Reaction ranges from extremely acid to strongly acid throughout the profile. The lower depth of the Oxic horizon is above 50 inches. Stones and cobbles range from 0 to 15 percent on the surface.

The A horizon has hue of 7.5YR or 10YR, value of 3 or 4, and chroma of 3 or 4. Texture is clay loam or clay.

The Bt horizon has hue of 2.5YR to 10YR, value of 4 to 6, and chroma of 4 to 8. Texture is clay loam or clay.

The Bo horizon, where present, has hue of 2.5YR to 10YR, value of 4 or 5 and chroma of 6 or 8. Texture is clay.

The Bw horizon has hue of 2.5YR to 7.5YR, value of 4 to 6 and chroma of 6 to 8. Texture is clay (using either 2.5 or 3 times the 15 bar water). Because of poor dispersion, the measured clay content ranges from 15 to 45 percent. Saprolite ranges from 0 to 20 percent, by volume, in the lower part.

COMPETING SERIES: There are no competing series in the same family.

GEOGRAPHIC SETTING: These soils are mountain sides or deeply dissected plateaus of uplands. They formed in residuum from sandstone material. The climate is humid tropical. Slopes range from 5 to 60 percent. The annual precipitation ranges from 100 to 140 inches and the average annual temperature ranges from 65 to 72 degrees F.

GEOGRAPHICALLY ASSOCIATED SOILS: These include the Moteado, Yunque, and Zarzal soils. The poorly drained Moteado soils are deep to bedrock. The moderately well drained Yunque soils have less clay in the control section. The moderately well drained Zarzal soils have a kaolinitic control section.

DRAINAGE AND PERMEABILITY: Well drained; moderate permeability.

USE AND VEGETATION: Watershed protection, recreation, research, and wildlife habitat. Most of the areas are now forested.

DISTRIBUTION AND EXTENT: Upland areas of Puerto Rico. The series is of small extent.

MLRA OFFICE RESPONSIBLE: Auburn, Alabama.

SERIES ESTABLISHED: Puerto Rico, 1936.

REMARKS: Diagnostic horizons and features recognized in this pedon:

Ochric epipedon - zone from 0 to 1 inch (A horizon).

Oxic horizon - zone from 1 to 31 inches (Bt horizons).

Cambic horizon - zone from 31 to 93 inches (Bw horizons).

LABORATORY DATA: Characterization data - Caribbean National Forest, Puerto Rico. Pedon No. 86P303 and Soil Survey No. S86PR-3-10. Sample by NSSL, Lincoln NE., February, 1986.

MLRA: 270.

National Cooperative Soil Survey
U.S.A.

LOCATION MACHUELO PR

Established Series
Rev. REG
06/2002

MACHUELO SERIES

The Machuelo series have dark grayish brown clay, plastic calcareous A and upper B horizons over clay, plastic, calcareous lower B and C horizons.

TAXONOMIC CLASS: Fine, mixed, superactive, calcareous, isohyperthermic Fluvaquentic Endoaquepts

TYPICAL PEDON: Machuelo clay - sugar cane - irrigated.
(Colors are for moist soils unless otherwise stated.)

Ap--0 to 8 inches; dark grayish brown (2.5YR 4/2) clay with few fine distinct yellowish brown, strong brown and gray mottles; moderate fine and medium granular structure; firm, slightly sticky, plastic; many fine roots; common fine volcanic fragments; strong effervescence, abrupt smooth boundary. (6 to 10 inches thick)

C1g--8 to 16 inches; dark gray (10YR 4/1) clay with few fine distinct greenish gray, few fine distinct light gray and few fine distinct yellowish brown mottles; weak medium and coarse subangular blocky structure to massive; firm, slightly sticky, plastic; many fine roots, common fine volcanic fragments; common fine limestone fragments; few shell fragments; strong effervescence; abrupt smooth boundary. (8 to 12 inches thick)

C2g--16 to 21 inches; dark gray (5Y 4/1) clay with common fine distinct olive yellow, few fine faint gray, and few fine distinct dark grayish brown mottles; weak medium subangular blocky structure to massive; firm, slightly sticky, plastic; common fine roots; common fine volcanic fragments; few fine limestone fragments; strong effervescence; clear smooth boundary. (4 to 8 inches thick)

C3g--21 to 29 inches; greenish gray (5GY 5/1) clay with many fine prominent yellowish brown, common fine prominent

olive yellow, few fine distinct bluish gray, few fine distinct dark bluish gray mottles; massive; firm, slightly sticky, plastic; few fine roots; few fine volcanic fragments; few fine limestone fragments; few fine shell fragments; slight effervescence; clear wavy boundary. (6 to 10 inches thick)

C4g--29 to 37 inches; light olive brown (2.5YR 5/6), greenish gray (5BG 5/1), and dark bluish gray (5BG 4/1) rubbed color gray (5Y 5/1) clay; massive; firm, sticky, plastic; common fine volcanic fragments; few fine limestone fragments; few shell fragments; water table at 32 inches (82 cm); strong effervescence; clear wavy boundary. (6 to 10 inches thick)

C5g--37 to 60 inches; olive (5Y 5/4), dark greenish gray (5BG 4/1), gray (5Y 5/1) and light olive brown (2.5Y 5/4), rubbed color dark greenish gray (5GY 4/1), clay, massive; firm, sticky, plastic; few fine volcanic fragments; few fine limestone fragments; few lime splotches; strong effervescence.

TYPE LOCATION: Sur SCD, Puerto Rico; 1.6 miles south of kilometer marker 123.75 of Highway No. 1.

RANGE IN CHARACTERISTICS: Depth to water table under irrigation ranges from 18 to 36 inches. Clay is the dominant texture throughout the profile.

The A horizons are dark grayish brown (10YR 3/2; 2.5Y 3/2) through brown (10YR 4/3) with gray and brown mottles.

The C horizons are dark gray (10YR 4/1; N 4/; 5Y 4/1), gray (10YR 5/1; N 5/; 5Y 5/1), greenish gray (5GY 5/1), light olive brown (2.5Y 5/6), or olive (5Y 5/4). They are mottled with grays, yellows, and browns. These soils have slightly sticky and plastic C horizons. Effervescence with dilute Hcl is strong or violent throughout.

COMPETING SERIES: These are the Coloso, Corcega, Fortuna, Talante, Vayas, and Zarzal series. The Coloso and Vayas soils are noncalcareous. The Corcega, Talante, and Zarzal soils are sandy at 20 to 30 inches (50-75 cm) from the surface. The Fortuna soils are acid.

GEOGRAPHIC SETTING: The Machuelo soils are on nearly level flood plains with slope gradients of 0 to 2 percent. The soil formed in clayey sediments washed out from the volcanic and limestone hills. The climate is semiarid. The average annual rainfall ranges from 25 to 40 inches and the mean annual temperature varies from 78 to 80 degrees F.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Cintrona, Constancia, Cortada, Jacaguas, and San Anton soils. The Cintrona and Constancia soils have darker colored surface layers and have calcic horizons. The Cortada and San Anton soils are loamy, well drained, and have darker colored surface layers. The Jacaguas soils have clay loam sola and are underlain by sand, gravel and cobbles at a depth of 20 inches or less.

DRAINAGE AND PERMEABILITY: Poorly drained; slow runoff; slow permeability.

USE AND VEGETATION: Most of the acreage has been planted to sugar cane for many years.

DISTRIBUTION AND EXTENT: Semiarid flood plains of Puerto Rico. The series is of minor extent.

MLRA OFFICE RESPONSIBLE: Auburn, Alabama

SERIES ESTABLISHED: Ponce Survey ARea, Puerto Rico; l971.

REMARKS: These soils were classified in the Alluvial great soil group.

National Cooperative Soil Survey
U.S.A.

LOCATION MARAGUEZ PR

Established Series
Rev. REG: LHR
08/2000

MARAGUEZ SERIES

The Maraguez series is well drained, moderately permeable soils formed in loamy materials weathered from volcanic rocks. They are steep and very steep soils on side slopes and ridges of the humid uplands. These soils are silty clay loam slightly acid in the A horizon; clay loam slightly acid in the cambic horizon and loam or silt loam in the C horizon.

TAXONOMIC CLASS: Fine-loamy, mixed, superactive, isohyperthermic Typic Eutrudepts

TYPICAL PEDON: Maraguez silty clay loam - shade grown coffee.
(Colors are for moist soils.)

Ap--0 to 6 inches; dark brown (10YR 3/3) silty clay loam; moderate fine and medium granular structure; firm, slightly sticky, slightly plastic; many fine and medium roots; few wormholes; fine and medium gravel 5 percent from 1/2 to 1 inch in diameter; slightly acid; clear wavy boundary. (5 to 7 inches thick)

B2--6 to 12 inches; brown (10YR 4/3) 60 percent and dark brown (10YR 3/3) 40 percent, clay loam; weak fine and medium subangular blocky structure; firm, slightly sticky, slightly plastic; few fine and medium roots; few wormholes; fine volcanic fragments 5 to 10 percent from 1/2 to 1 inch in diameter; slightly acid; clear wavy boundary. (4 to 7 inches thick)

B3--12 to 21 inches; dark yellowish brown (10YR 4/4) loam; weak fine subangular blocky structure; friable, slightly sticky, slightly plastic; few fine and medium roots; fine subangular volcanic fragments 5 to 10 percent from 1/2 to 1 inch in diameter; common fine quartz grains; slightly acid; clear wavy boundary. (7 to 10 inches thick)

C--21 to 60 inches; yellowish brown (10YR 5/4) loam; massive; friable, slightly sticky, slightly plastic; few fine and

medium roots; fine and medium volcanic fragments 5 to 10 percent from 1/2 to 1 inch in diameter; many fine quartz grains; medium acid.

TYPE LOCATION: Sur SCD, Puerto Rico, 50 feet east of kilometer marker 16.1 on Highway 139.

RANGE IN CHARACTERISTICS: Thickness of the solum ranges from 16 to 24 inches. Depth to the semi-consolidated volcanic rock is over 60 inches. Consistence is slightly sticky and slightly plastic in the whole profile. Reaction is medium or slightly acid. Fine rock fragments range from 2 to 10 percent throughout. Organic carbon decreases regularly with depth. The mean annual soil temperature is 76 degrees F.

The A horizon has hue of 10YR, values of 3 or 4, and chroma of 2 and 3. Texture is silty clay loam. Structure is weak or moderate, fine or medium granular.

The B2 horizons have matrix colors in hues of 10YR, values or 4 or 5, and chroma of 3 and 4. Texture of the B2 horizon is clay loam, silty clay loam, or loam. Texture of the B3 horizon is loam or silt loam. Structure of the B horizons is weak fine or medium subangular blocky.

The C horizon is loam or silt loam.

COMPETING SERIES: This is the Morado series in the same family. The Caguabo, Juncos, Junquitos, Mabi, Malaya, Maresua, Montegrande, Mucara, Pandura, Plata and Quebrada series are similar soils in related families. The Marado soils are pinkish and are shallower to the semi-consolidated rock. The Caguabo and Malaya soils are shallower to the volcanic rock. The Juncos, Mabi, Montegrande and Mucara soils all have finer textured and have higher COLE values. The Junquitos soils have finer texture and low chroma mottles. The Maresua soils have finer texture and are gravelly throughout. The Pandura are coarser textured and shallow to the weathered rock. The Plata soils have more than 35 percent by volume of gravel. The Quebrada soils are finer texture throughout.

GEOGRAPHIC SETTING: The Maraguez soils are steep and very steep soils on side slopes and ridges of strongly dissected volcanic uplands with slope gradients of 20 to 60 percent. The soil formed in moderately medium textured residuum weathered from basic volcanic rocks. The climate is humid tropical. The average annual precipitation ranges from 60 to 70 inches and the mean annual temperature ranges from 76 to 78 degrees F.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the competing Morado, Mucara, Quebrada, and Caguabo soils. The Caguabo soils are underlain by hard rock at 20 inches or less.

DRAINAGE AND PERMEABILITY: Well drained; very rapid runoff; moderate permeability.

USE AND VEGETATION: Most of the acreage is in native pasture and shade grown coffee.

DISTRIBUTION AND EXTENT: Humid uplands of Puerto Rico. The series is of minor extent with about 13,000 acres.

MLRA OFFICE RESPONSIBLE: Auburn, Alabama

SERIES ESTABLISHED: Ponce Survey Area, Puerto Rico; 1971.

National Cooperative Soil Survey
U. S. A.

LOCATION MARICAO PR

Established Series
Rev. BCD
06/2002

MARICAO SERIES

The Maricao series consists of very deep, well drained, moderately permeable soils formed in material weathered from volcanic rocks. They are steep and very steep soils on strongly dissected uplands. Slopes range from 20 to 60 percent. The mean annual precipitation is about 110 inches and the mean annual temperature is about 72 degrees F.

TAXONOMIC CLASS: Fine, mixed, subactive, isohyperthermic Inceptic Hapludults

TYPICAL PEDON: Maricao clay -- native pasture. (Colors are for moist soil.)

Ap--0 to 5 inches; reddish brown (5YR 4/4) clay, some mixture of red (2.5YR 5/8) from underlying horizon; weak fine and medium subangular blocky parting to moderate medium granular structure; firm, slightly sticky, plastic; many fine roots; few worm channels; very strongly acid; clear smooth boundary. (4 to 7 inches thick)

Bt--5 to 14 inches, red (2.5YR 5/8) clay, coatings of light red (2.5YR 6/8) and yellowish red (5YR 5/8); weak medium subangular blocky structure; firm, slightly sticky, plastic; common fine roots; few faint clay films; 10 percent of horizon is saprolite; 2 percent firm weathered rock fragments; very strongly acid; clear wavy boundary. (6 to 9 inches thick)

BC--14 to 20 inches; red (2.5YR 5/8) clay, and mixed colors from the saprolite; weak fine subangular blocky structure; friable, slightly sticky, palstic; few fine roots; 40 percent of horizon is saprolite; very strongly acid; clear wavy boundary. (5 to 12 inches thick)

C--20 to 60 inches; crushed color red (2.5YR 5/8) silty clay loam, variegated colors of saprolite; massive, saprolite; friable, nonsticky, slightly plastic; very strongly acid.

TYPE LOCATION: Oeste SCD, Puerto Rico; 7.0 miles southeast of the town of Maricao; 2.3 kilometers on dirt road south of kilometer marker 44.5 of Highway 105; 25 meters west of dirt road.

RANGE IN CHARACTERISTICS: Solum thickness ranges from 15 to 25 inches. Thickness of the argillic horizon ranges from 6 to 16 inches. Depth to semi-consolidated tuffs, mudstone or lava is more than 5 feet. The soil is extremely acid or very strongly aicd. The mean annual soil temperature ranges from 68 to 72 degrees F.

The A horizons have hues of 2.5YR or 5YR, values of 4 or 5, and chroma of 3 to 6. They are clay.

The Bt horizons have hues of 2.5YR or 5YR, values of 4 or 5, and chroma of 6 or 8. They are clay. Structure is weak fine or medium subangular blocky. The Bt horizon has 5 to 20 percent saprolite and the BC horizon has 20 to 60 percent saprolite.

The C horizon has crushed hues of 2.5YR or 5YR, values of 4 to 6, and chroma of 4 to 8. They are silty clay or silty clay loam.

COMPETING SERIES: Theser are no other know series in the same family.

The Ciales, Consumo, Corozal, Ingenio, Moca, Patillas, and Vega Alta series and similar soils in related families. All of these soils except Ciales soils have isohyperthermic temperature regimes. Ciales soils have argillic horizons thicker than 16 inches and have gray mottles.

GEOGRAPHIC SETTING: The Maricao soils are steep and very steep soils on strongly dissected uplands at elevations above 550 meters, with slope gradients of 20 to 60 percent. The soils formed in highly weathered residuum from basic volcanic rocks. The climate is humid tropical with annual precipitation that ranges from 90 to 120 inches and mean annual temperature of 70 to 74 degrees F.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the competing Ciales series and the Cuchillas, Los Guineos, Picacho, and Yunque soils. Cuchillas soils have a cambic horizon. Los Guineos and Yunque soils have hue of 10YR and mottles in the upper part of the B horizon. Picacho soils have low chroma mottles in the argillic horizon.

DRAINAGE AND PERMEABILITY: Well drained; rapid runoff; moderate permeability.

USE AND VEGETATION: Most of the acreage is in brushland or abandoned coffee plantations. Small acreage is used for growing native pasture, tame pasture, and coffee.

DISTRIBUTION AND EXTENT: Humid and high elevation areas of Puerto Rico. The series is of moderate extent with about 36,000 acres.

MLRA OFFICE RESPONSIBLE: Auburn, Alabama

SERIES ESTABLISHED: Puerto Rico, (Ponce Survey Area), 1971.

REMARKS: The classification was updated with the 4/91 draft from Clayey, mixed, isothermic Dystropeptic Tropudults to Clayey, mixed, isothermic Ochreptic Hapludults with this draft. The previous OSED date was 5/75.

Diagnostic horizons and features recognized in this pedon:

Ochric epipedon - zone from 0 to 5 inches (Ap horizon)

Argillic horizon - zone from 5 to 14 inches (Bt horizon)

Ochreptic feature - Bt horizon less than 10 inches thick.

National Cooperative Soil Survey
U.S.A.

LOCATION MEROS PR

Established Series
Rev. LHR
6/71

MEROS SERIES

The Meros series have very dark grayish brown, sandy A horizons underlain by brownish sandy C horizons.

TAXONOMIC CLASS: Mixed, isohyperthermic Typic Ustipsamments

TYPICAL PEDON: Meros sand - pasture
(Colors are for moist soil unless otherwise stated.)

A11--0 to 8 inches; very dark grayish brown (10YR 3/2) fine sand; single grained; loose, nonsticky, nonplastic; many fine roots; common fine black minerals; neutral; clear smooth boundary. (6 to 10 inches thick)

A12--8 to 14 inches; very dark brown (10YR 2/2) fine sand; single grained; loose, nonsticky, nonplastic; few fine roots; many fine black minerals; neutral; clear smooth boundary. (6 to 10 inches thick)

C1--14 to 22 inches; very dark grayish brown (10YR 3/2) fine sand; single grained; loose, nonsticky, nonplastic; few fine roots; neutral; clear smooth boundary. (8 to 12 inches thick)

C2--22 to 40 inches; dark yellowish brown (10YR 4/4) and black (10YR 2/1) sand; single grained; loose, nonsticky, nonplastic; mildly alkaline; clear smooth boundary. (16 to 24 inches thick)

C3--40 to 50 inches; olive brown (2.5Y 4/4) sand; single grained; loose, nonsticky, nonplastic; mildly alkaline; clear smooth boundary. (8 to 16 inches thick)

C4--50 to 60 inches; very dark grayish brown (2.5Y 3/2) sand; single grained; loose, nonsticky, nonplastic; moderately alkaline.

TYPE LOCATION: Sudeste Soil and Water Conservation District, Puerto Rico; 150 feet north of kilometer marker 93.8 of Highway 1 and 20 feet east of Tamarindo tree.

RANGE IN CHARACTERISTICS: The soil texture in all horizons is sand or fine sand. The mean annual soil temperature ranges from 78 to 80 degrees F.

Color of the A horizon is black (N 2/), very dark brown (10YR 2/2), very dark grayish brown (10YR 3/2; 2.5Y 3/2), or dark brown (10YR 3/3). It is neutral or mildly alkaline.

The C horizon is very dark grayish brown, through dark olive hues of 10YR, 2.5Y or 5Y, value of 3 or 4, and chromas of 2 through 4. It is neutral through moderately alkaline.

COMPETING SERIES AND THEIR DIFFERENCES: These are the Aguadilla and Arenales series in the same family and Catano, Espinal, Falfurrias, and Jaucas series. The Aguadilla, Catano, and Espinal soils have udic moisture regimes. The Arenales soils have well graded soil materials in the control section consisting of silts, coarse sand, and gravel. The Falfurrias soils have more than 9 degrees F., difference between mean summer and mean winter temperatures. The Jaucas soils have carbonatic mineralogy.

GEOGRAPHIC SETTING: The Meros soils occur on nearly level benches along the coast at elevations slightly above sea level. Slope gradients are 0 to 2 percent. The soil formed in sandy sediments derived from sand sized volcanic fragments, sea shells, and corals. The climate is semiarid tropical. The average yearly precipitation is 35 to 40 inches. The mean annual temperature is about 79degrees F.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Hydraquents and Coastal beach land types. Coastal beach is a land type that consists of miscellaneous sandy materials reworked by wave action. Hydraquents are the clayey soils of the tidal marches that are permanently saturated with water.

DRAINAGE AND PERMEABILITY: Excessively drained; slow runoff; very rapid permeability.

USE AND VEGETATION: Used mostly for pasture and coconuts.

DISTRIBUTION AND EXTENT: Semiarid coastal areas of Puerto Rico. The series is of small extent.

MLRA OFFICE RESPONSIBLE: Auburn, Alabama

SERIES ESTABLISHED: Soil Survey of Puerto Rico; l936.

REMARKS: The Meros series was classified in the Regosol great soil group.

National Cooperative Soil Survey
U.S.A.

LOCATION MONTEGRANDE PR

Established Series
Rev. REG
07/2001

MONTEGRANDE SERIES

The Montegrande series have dark yellowish brown, fine textured A horizons and dark yellowish brown, low chroma mottled, fine textured B horizons that crack when dry over C horizons that have more than 35 percent coarse fragments by volume.

TAXONOMIC CLASS: Very-fine, mixed, superactive, isohyperthermic Chromic Hapluderts

TYPICAL PEDON: Montegrande clay - sugar cane (Colors are for moist soils unless otherwise stated.)

Ap--0 to 6 inches; dark yellowish brown (10YR 3/4) clay; weak medium subangular blocky structure with few pressure faces; firm, slightly sticky, plastic; many fine roots; common fine volcanic fragments; few fine black concretions; strongly acid; clear smooth boundary. (5 to 8 inches thick)

B1--6 to 10 inches; dark grayish brown (10YR 4/2) clay; weak medium subangular blocky structure with pressure faces; firm, slightly sticky, plastic; common fine roots; few fine volcanic fragments; common fine black concretions; strongly acid; clear wavy boundary. (4 to 9 inches thick)

B2--10 to 14 inches; dark yellowish brown (10YR 3/4) clay with many fine distinct yellowish brown (10YR 5/6, 5/4, 5/8), and gray (10YR 5/1) mottles; moderate medium angular blocky structure with pressure faces and slickensides; firm, slightly sticky, plastic; few fine roots; many fine and few medium volcanic fragments; many fine black concretions; strongly aid; clear smooth boundary. (4 to 8 inches thick)

B3--14 to 24 inches; yellowish brown (10YR 5/6) clay with many medium distinct gray 910YR 5/1) mottles; crushed

color dark yellowish brown (10YR 4/4), weak medium angular blocky structure with slickensides; few fine roots; many sand size volcanic fragments; few fine white concretions; many fine black concretions; mildly alkaline; clear smooth boundary. (7 to 11 inches thick)

11C1--24 to 32 inches; yellowish brown (10YR 5/6) gravelly clay with many medium distinct gray (10YR 5/1) and few fine distinct grayish brown (10YR 5/2) mottles; massive; friable; slightly sticky, slightly plastic; volcanic fragments 1/8 to 1 inch and many fine black concretions; mildly alkaline; clear smooth boundary. (7 to 15 inches thick)

11C2--32 to 60 inches; gray (10YR 5/1) gravelly clay with many medium distinct yellowish brown (10YR 5/6) and gray (5YR 5/1) mottles; dark brown (7.5YR 4/2) crushed; massive; friable, slightly sticky and nonplastic; volcanic fragments 1/4 to 1/2 inch in size make up more than 60 percent of the horizon; many fine black and few fine white concretions; moderately alkaline. There are thin lenses and strata of fine material interbedded.

TYPE LOCATION: Suroeste SCD, Puerto Rico, 5.0 miles west of the town of San German; 150 feet south on dirt road from kilometer marker 5.3 of Highway 102; 20 feet west of dirt road.

RANGE IN CHARACTERISTICS: Thickness of solum and depth to the gravelly horizons varies from 20 to 36 inches.

The A horizons have hues of 10YR, values of 3 or 4, and chromas of 2, 3, or 4.

The B2 horizons have hues of 10YR or 2.5Y with low chroma mottles. Clay is the dominant texture throughout.

From 50 to 70 percent by volume of the lower C horizons consists of volcanic fragments that range in size from 1/8 to 1 inch.

Pressure faces are present in the A horizons. The B2 horizons have cracks during the dry season, and slickensides. Reaction in the upper B horizons ranges from strongly to medium acid in the C horizons from annual soil temperature ranges from 73 to 78 degrees F.

COMPETING SERIES: These are the Gurabo, Juncos, and Mucara series in the same subgroup and Jacana, Llanos,

Maguayo, and Parcelas series. The Gurabo soils have loamy textures in the lower half of the control section. The Juncos soils have montmorillonitic mineralogy and have semi-consolidated volcanic rocks below 20 inches. The Mucara soils and Maguayo soils are drier with ustic soil moisture regimes. The Parcelas soils have base saturations below 50 percent.

GEOGRAPHIC SETTING: The Montegrande soils occur on alluvial fans and foot slopes of volcanic hills with slope gradients of 2 to 12 percent. The soil formed in stratified fine textured sediments over gravelly strata washed from the surrounding volcanic hills. The climate is humid tropical, the average annual precipitation is 76 inches, and the mean annual temperature is 77 degrees F.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Caguabo series in addition to the competing Mucara series. The Caguabo series has hard rock within 20 inches. Both series occur in adjacent higher positions in the landscape.

DRAINAGE AND PERMEABILITY: Moderately well drained; medium runoff; moderately slow permeability.

USE AND VEGETATION: Most of the acreage is in sugarcane.

DISTRIBUTION AND EXTENT: Humid inner valleys of Puerto Rico. The series is of minor extent.

MLRA OFFICE RESPONSIBLE: Auburn, Alabama

SERIES ESTABLISHED: Ponce Survey Area, Puerto Rico; 1971.

REMARKS: This is a format update only performed by the NSSQA Staff on 8/89.

The soil was formerly classified in the Reddish Prairie great soil group.

National Cooperative Soil Survey
U.S.A.

LOCATION MORADO PR

Established Series
Rev. REG:LHR
06/2002

MORADO SERIES

The Morado series consists of moderately deep, well drained soils formed in materials weathered from volcanic rocks. They are moderately steep to very steep soils on side slopes and ridgetops of the dissected uplands. They are friable clay loam in the A and B horizons over loam saprolite of variegated colors. Semi-consolidated volcanic rock is at 33 inches.

TAXONOMIC CLASS: Fine, mixed, superactive, isohyperthermic Dystric Eutrudepts

TYPICAL PEDON: Morado clay loam - pigeon peas.
(Colors are for moist soil.)

Ap--0 to 7 inches; dark reddish gray (10YR 4/1) clay loam; weak fine subangular blocky structure; friable, slightly sticky, plastic; common fine roots; neutral; clear smooth boundary. (4 to 7 inches thick)

B2--7 to 17 inches; reddish gray (5YR 5/2) clay loam with few fine faint weak red (2.5YR 4/2), yellowish red (5YR 4/6) and reddish brown (5YR 4/3) mottles; weak fine subangular blocky structure breaking to weak fine granular; friable, slightly sticky, plastic; common fine roots; slightly acid; gradual wavy boundary. (6 to 11 inches thick)

B3--17 to 24 inches; variegated colors, brown, dark brown (7.5YR 4/2), dark reddish gray (5YR 4/2) and dark gray (5YR 4/1) clay loam; weak fine subangular blocky structure; friable, slightly sticky, plastic; few fine roots; slightly acid; clear wavy boundary. (6 to 12 inches thick)

C--24 to 33 inches; variegated colors; brown, dark brown (7.5YR 4/2), dark reddish gray (5YR 4/2) and dark gray (5YR 5/1) loam; massive; friable, slightly sticky, slightly plastic; slightly acid. (6 to 12 inches thick)

R--33 plus inches ; reddish gray, semi-consolidated volcanic rock.

TYPE LOCATION: Oeste SCD, Puerto Rico; 6.5 miles northwest of the city of Mayaguez; 500 meters on dirt road from kilometer marker 3.85 on Highway 406 and 100 feet north of dirt road.

RANGE IN CHARACTERISTICS: Thickness of the solum ranges from 16 to 30 inches. Depth to the semi-consolidated volcanic rock varies from 22 to 42 inches. These soils are slightly sticky and plastic or slightly plastic throughout. The mean annual soil temperature ranges from 74 76 degrees F.

The A horizon has hues of 5YR to 10R, values of 4 or 5, and chroma of 1 or 3. It is clay loam or silty clay loam. Consistence is slightly sticky and plastic or slightly plastic. Reaction is neutral or slightly acid.

The B2 horizon has hues of 5YR to 2.5YR, values of 4 or 5, and chromas of 2 to 4. Some pedons have weak red, yellowish red and reddish brown mottles. Texture varies from clay loam to silty clay loam. Structure of the B2 horizon when present has 40 to 50 percent saprolite. Reaction varies from medium acid to neutral.

The C horizon is loam or clay loam.

COMPETING SERIES: The Maraguez series is in the same family. The Maraguez soils are deeper in the semi-consolidated rock and have yellower colors in hue of 10YR. The Caguabo, Juncos, Junquitos, Mabi, Malaya, Maresua, Montegrande, Mucara, Pandura, Plata and Quebrada are the soils in similar familes. Caguabo and Malaya soils are shallower to the volcanic rocks. The Juncos, Mabi, Montegrande, and Mucara soils are all finer textured and have higher COLE value. The Junquitos soils are finer textured and have low chroma mottles. The Maresua soils are finer textured and are gravelley throughout. The Pandura soils are coarser textured throughout. The Plata soils have more than 35 percent by volume of gravel. The Quebrada soils have finer soil texture throughout.

GEOGRAPHIC SETTING: The Morado soils are strongly sloping to very steep soils on side slopes and ridgetops of dissected uplands with slope gradients of 12 to 60 percent. The soil formed in moderately fine and medium textured residuum weathered from volcanic rocks. The climate is humid tropical. The average annual precipitation is 88 inches and the mean annual temperature is 76 degrees F.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the competing Caguabo, Maraguez, Mucara, and the Quebrada series. All of these soils occur in similar positions.

DRAINAGE AND PERMEABILITY: Well drained; rapid runoff; moderate permeability.

USE AND VEGETATION: Coffee, pasture and brush.

DISTRIBUTION AND EXTENT: Humid uplands of Puerto Rico. The series is of moderate extent about 34,000 acres.

MLRA OFFICE RESPONSIBLE: Auburn, Alabama

SERIES ESTABLISHED: Ponce Survey Area, Puerto Rico; 1971.

ADDITIONAL DATA: Characterization data are available of the typical pedon. S61PR-8-2.

National Cooperative Soil Survey
U. S. A.

LOCATION MUCARA PR

Established Series
Rev. GRB
06/2002

MUCARA SERIES

The Mucara series consists of moderately deep, well drained soils on side slopes of strongly dissected uplands. They formed in material that weathered from igneous rocks. Near the type location, the mean annual precipitation is about 78 inches and the mean annual temperature is about 76 degrees F. Slopes range from 15 to 70 percent.

TAXONOMIC CLASS: Fine-loamy, mixed, superactive, isohyperthermic Dystric Eutrudepts

TYPICAL PEDON: Mucara clay - pasture. (Colors are for moist soil)

Ap--0 to 6 inches; very dark grayish brown (10YR 3/2) clay; weak medium granular structure; firm, slightly sticky, plastic; few fine black (10YR 2/1) concretions; many fine roots; moderately acid; clear smooth boundary. (4 to 8 inches thick)

Bw--6 to 12 inches; about 50 percent very dark grayish brown (10YR 3/2) and about 50 percent brown (10YR 5/3) clay; weak medium subangular blocky structure; firm, slightly sticky, plastic; common fine roots along structural faces; few distinct pressure faces on surfaces of peds; slightly acid; abrupt irregular boundary. (6 to 12 inches thick)

C--12 to 22 inches; brown (10YR 4/3) loam; massive; friable; slightly sticky, slightly plastic; few fine roots; about 30 percent, by volume, saprolite; few distinct tongues of B material; neutral; gradual wavy boundary. (10 to 16 inches thick)

R--22+ inches; semi-consolidated igneous rock.

TYPE LOCATION: Suroeste SCD, Puerto Rico. Approximately 1.5 miles east of bridge of Highway 2 over the

Rosario River and about 100 feet north of the highway.

RANGE IN CHARACTERISTICS: Solum thickness ranges from 10 to 20 inches. Rock fragments range from 0 to 15 percent, by volume. Depth to semi-consolidated rock ranges from 20 to 40 inches. Reaction ranges from moderately acid to neutral in the A and Bw horizons and slightly acid or neutral in the C horizon.

The A horizon has hue of 5YR to 2.5Y, value of 2 to 5, and chroma of 2 to 4. Texture is silty clay loam, silty clay, or clay.

The Bw horizon has hue of 7.5YR to 2.5Y, value of 3 to 6, and chroma of 2 to 6. Texture is clay loam, silty clay, or clay.

The BC horizon, where present, has colors and textures similar to the Bw horizon.

The C horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2 to 4; or there is no dominant color and is multicolored in shades of brown, yellow, and gray. Texture is loam or clay loam.

The R layer is semi-consolidated igneous rock.

COMPETING SERIES: There no competing series in the same family.

GEOGRAPHIC SETTING: Mucara soils are on side slopes of strongly dissected uplands. They formed in fine-textured residuum weathered from basic igneous rock. The climate is humid tropical. Slopes range from 15 to 70 percent. The average annual precipitation ranges from 75 to 80 inches and the average annual temperature ranges from 75 to 77 degrees F.

GEOGRAPHICALLY ASSOCIATED SOILS: These include the Caguabo, Maraguez, Morado, and Quebrada series. These soils are on similar landscape positions. In addition, Caguabo soils are shallow to bedrock, Maraguez soils are very deep and have less clay in the subsoil, Morado soils have less clay in the subsoil, and Quebrada soils are very deep and have mixed mineralogy in the control section.

DRAINAGE AND PERMEABILITY: Well drained; moderate permeability.

USE AND VEGETATION: Many areas of Mucara soils are used for growing sugarcane, food crops, coffee, and pastureland. Some areas are in woodland. Vegetation consists of native and introduced species.

DISTRIBUTION AND EXTENT: Humid uplands of Puerto Rico. The series is of major extent.

MLRA OFFICE RESPONSIBLE: Auburn, Alabama.

SERIES ESTABLISHED: Puerto Rico, 1942.

REMARKS: Diagnostic horizons and features recognized in this pedon:

Ochric epipedon - the zone from 0 to 6 inches (Ap horizon).

Cambic horizon - the zone from 6 to 12 inches (Bw horizon).

MLRA: 270.

National Cooperative Soil Survey
U.S.A.

LOCATION PASO SECO PR

Established Series
Rev. REG-RLV
08/2000

PASO SECO SERIES

The Paso Seco series consists of very deep, moderately well drained, slowly permeable soils on alluvial fans. They formed in fine textured sediments overlying gravelly, medium textured sediments. These soils have gilgai surface relief where not cultivated. Slopes range from 0 to 5 percent. The mean annual precipitation is about 35 inches and the mean annual temperature is about 79 degrees F.

TAXONOMIC CLASS: Fine, mixed, superactive, isohyperthermic Entic Udic Haplusterts

TYPICAL PEDON: Paso Seco clay - native pasture. (Colors are for moist soil unless otherwise stated.)

Ap--0 to 6 inches; very dark grayish brown (10YR 3/2) clay; moderate medium and coarse subangular blocky structure; hard, slightly sticky, plastic, many fine roots; few fine pores; common cracks 2 to 3 centimeters wide; many pressure faces; common fine rounded and subrounded rock fragments; few pockets of dark brown clay between cracks; neutral; clear wavy boundary. (5 to 10 inches thick)

ABss1--6 to 19 inches; dark yellowish brown (10YR 3/4) clay; intersecting slickensides-with numerous parallelepipeds; firm, sticky, plastic; common fine roots; few fine pores; common cracks 2 to 3 centimeters wide; few fine concretions; common fine rounded and subrounded rock fragments; streaks of very dark brown from above; neutral; gradual wavy boundary. (5 to 15 inches thick)

ABss2--19 to 28 inches; dark yellowish brown (10YR 3/4) clay; intersecting slickensides; sticky, plastic; few fine roots, common fine pores; common cracks 1 to 2 centimeters wide; common rounded and subrounded rock fragments; few dark concretions; mildly alkaline; clear smooth boundary. (5 to 12 inches thick)

BC--28 to 32 inches; dark brown (7.5YR 4/4) gravelly clay; massive; firm, slightly sticky, slightly plastic; many gravel fragments 1/8 to 1 inch in diameter; mildly alkaline; clear smooth boundary. (4 to 15 inches thick)

2C--32 to 40 inches; dark brown (7.5YR 4/4) very gravelly loam; massive; very friable, nonsticky, nonplastic; many rounded rock fragments 1/8 to 3 inches in diameter; mildly alkaline.

TYPE LOCATION: Sudeste SCD, Salinas, Puerto Rico; 0.15 mile north from kilometer marker 148.6 of Highway 3, 35 feet west of farm road.

RANGE IN CHARACTERISTICS: Depth to the discontinuity ranges from 28 to 35 inches. The soil is usually moist, but when dry it has cracks ranging from 0.5 to 3 inches in width extending to the very gravelly 2C horizons. Cracks are open from 90 to 150 days (cumulative) during most years. The soil is clayey throughout the A, ABss and BC horizons. The typifying pedon is from a microlow. Cycles of microlows and microhighs are repeated each 7 to 15 feet. The thickness of the A and ABss horizons varies from 30 inches in the microlow to 15 inches in the microhigh. Reaction throughout the A, ABss and BC horizons ranges from neutral in the microlows through mildly alkaline in the microhighs. Intersecting slickensides are common in the A ABss horizon.

The A and ABss horizons have hue of 10YR, value of 3, and chroma 2 through 4. Texture is clay.

The BC horizon has hue of 7.5YR or 10YR, value of 4, and chroma of 4. It ranges from clay to gravelly clay.

The 2C horizon has hue of 7.5YR or 10YR, value of 4, and chroma of 4. Texture is very gravelly loam or very gravelly clay loam with 35 to 60 percent by volume of gravel.

COMPETING SERIES: These are the Aguirre, Cartagena, Fe, Fraternidad, Guanica, and Poncena series in similar subgroups. Aguirre, Guanica, and Poncena soils are less well drained and have A horizons with colors of lower chroma. In addition, Poncena soils have a calcic horizon. The Cartagena, Fe, and Fraternidad soils lack horizons with more than 35 percent gravel within 40 inches of the soil surface.

GEOGRAPHIC SETTING: The Paso Seco soils occur on nearly level to gently sloping alluvial fans. Slope gradients range from 0 to 5 percent. The soil formed in fine textured sediments of mixed origin which overlie gravelly medium

textured sediments. The climate is semiarid tropical. Average yearly rainfall is 30 to 40 inches and mean annual air temperature is 78 to 80 degrees F.

GEOGRAPHICALLY ASSOCIATED SOILS: In addition to the competing Cartagena and Fraternidad soils, these are the Jacana soils. Jacana soils are on higher positions with rock within 40 inches.

DRAINAGE AND PERMEABILITY: Moderately well drained; slow runoff; slow permeability.

USE AND VEGETATION: Where irrigated, most acreage is used for growing sugarcane. Areas not irrigated are in native grasses and used as pasture.

DISTRIBUTION AND EXTENT: Coastal Plains of southern Puerto Rico. The series is of small extent.

MLRA OFFICE RESPONSIBLE: Auburn, Alabama

SERIES ESTABLISHED: Puerto Rico; 1936

REMARKS: The classification was previously updated with the 4/91 draft from Clayey over loamy-skeletal, mixed, isohyperthermic Udic Chromusterts to Fine, mixed, isohyperthermic Entic Chromusterts. The previous OSED was dated 6/71.

Diagnostic horizons and features recognized in this pedon:

Slickensides and vertic features - zone from 6 to 28 inches (ABss and BC horizons)

National Cooperative Soil Survey
U.S.A.

LOCATION PELLEJAS PR

Established Series
Rev. REG
06/2002

PELLEJAS SERIES

The Pellejas series have dark grayish brown, granular, clay loam A horizons and dark brown, clay loam B horizons over thick, light brownish gray, loamy sand C horizons.

TAXONOMIC CLASS: Fine-loamy over sandy or sandy-skeletal, mixed, subactive, isohyperthermic Typic Dystrudepts

TYPICAL PEDON: Pellejas clay loam - native pasture.
(Colors are for moist soil unless otherwise stated.)

Ap--0-5 inches; Dark grayish brown (10YR 4/2) clay loam; moderate fine granular structure; firm, slightly sticky, slightly plastic, many fine roots, many fine quartz grains; strongly acid; clear smooth boundary. (4 to 6 inches thick)
B2--5-11 inches; Dark brown (10YR 4/3) clay loam; weak medium subangular blocky structure; firm, slightly sticky, plastic, many fine roots; common fine and few medium quartz grains; strongly acid; clear wavy boundary. (4 to 9 inches thick)

B3--11-15 inches; Pale brown (10YR 6/3) 60 percent, dark yellowish brown (10YR 4/4) 20 percent rubbed color light brownish gray (2.5Y 6/2) sandy loam; weak fine and medium subangular blocky structure; friable, nonsticky, slightly plastic, common fine roots; many fine quartz grains; many fine black and white specks; strongly acid; clear wavy boundary. (3 to 5 inches thick)

C--15-60 inches; Light brownish gray (2.5 6/2) loamy sand; single grained; very friable, nonsticky, nonplastic, strongly acid.

TYPE LOCATION: Sur SCD, Puerto Rico; 100 meters north of kilometer marker 44.5 of Highway No. 10.

RANGE IN CHARACTERISTICS: Thickness of the solum ranges from 11 to 20 inches. These soils are strongly or very strongly acid. Mean annual soil temperature ranges from 75 to 78 degrees F.

The A horizons are dark grayish brown (10YR 4/2), or dark brown (10YR 4/3). Clay loam is the dominant type.

The B horizons become lighter with depth and range from dark brown (10YR 4/3), to dark yellowish brown (10YR 4/4), yellowish brown (10YR 5/4), pale brown (10YR 6/3), or light yellowish brown (10YR 6/4). The upper B horizons are loam or clay loam. The lower B horizons are sandy loam or loamy sand. Structure of the B horizons ranges from weak fine to weak medium subangular blocky inclusive. These soils have slightly sticky and slightly plastic A horizons and slightly sticky and plastic upper B horizons.

COMPETING SERIES: These are the Anones, Mayo, Pandura, Santa Marta, Utuado, Vieques, and Yunes series. The Anones and Santa Marta soils have oxidic mineralogy and fine texture. The Mayo soils are coarser textured throughout the solum. The Pandura soils are shallow to partially weathered plutonic rocks and are less acid. The Utuado soils have cooler soil temperatures and occur in higher elevations. The Vieques soils are drier having ustic soil moisture regimes. The Yunes soils are shallow to shaly sedimentary rocks and have 60 to 80 percent by volume of shaly fragments in the cambic horizon.

GEOGRAPHIC SETTING: The Pellejas soils occur on moderately steep and steep sideslopes and narrow ridges with slope gradients of 40 to 60 percent. The soil formed in coarse textured residuum weathered from plutonic rocks. The climate is humid tropical. The average annual precipitation ranges from 70 to 90 inches and the mean annual temperature is 76 to 78 degrees F.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Lirios soils which occur in the sideslopes of the humid uplands. The Lirios soils have formed in the same kind of material, but are red, deeper to saprolite, and have argillic horizons.

DRAINAGE AND PERMEABILITY: Somewhat excessively drained; very rapid runoff; rapid permeability.

USE AND VEGETATION: Mostly used for coffee and pasture.

DISTRIBUTION AND EXTENT: Humid uplands of Puerto Rico. The series is of large extent.

MLRA OFFICE RESPONSIBLE: Auburn, Alabama

SERIES ESTABLISHED: Ponce Survey Area, Puerto Rico; 1971.

REMARKS: The Pellejas soils were formerly classified in the Gray Brown Podzolic great soil group.

National Cooperative Soil Survey
U.S.A.

LOCATION QUEBRADA PR

Established Series
Rev. REG
06/2002

QUEBRADA SERIES

The Quebrada series have plastic, fine textured, slightly acid or neutral A and B horizons over deep, friable, nonplastic saprolite.

TAXONOMIC CLASS: Fine, mixed, active, isohyperthermic Dystric Eutrudepts

TYPICAL PEDON: Quebrada silty clay - native pasture.
(Colors are for moist soil unless otherwise stated.)

Ap--0-7 inches; Dark brown (10YR 3/3) silty clay loam; moderate fine and medium granular structure; firm, hard when dry, slightly sticky, plastic; many fine roots; 10 percent by volume subangular volcanic rock fragments; common fine black concretions; slightly acid; clear smooth boundary. (5 to 8 inches thick)

B--7-14 inches; Dark yellowish brown (10YR 4/4) clay; weak medium subangular blocky structure; firm, slightly sticky, plastic; common fine roots; neutral; gradual wavy boundary. (7 to 10 inches thick)

C--14-50 inches; Weathered parent material with variegated colors as very dark brown, gray, and greenish gray; silty clay loam; massive; friable, slightly sticky, nonplastic; neutral.

TYPE LOCATION: Caribe SCD, Puerto Rico; 1.5 miles east of kilometer marker 5.9 of Highway 151.

RANGE IN CHARACTERISTICS: Thickness of the solum ranges from 12 to 18 inches (30-46cm). Depth to the semi-consolidated rock is over 5 feet. These soils have slightly sticky and plastic A and B horizons and slightly sticky and

nonplastic C horizon. They are medium acid through neutral. Rock fragments comprise less than 20 percent by volume of the soil mass. The mean annual soil temperature ranges from 75 to 78 degrees F.

The A horizon has hues of 10YR, values of 3 and chromas of 3.

The B horizon has hues of 10YR, values of 4 or 5, and chromas of 4 and higher. The C horizon has variegated colors of the saprolite as greenish gray, bluish gray, gray, and browns in varying amounts. The A horizon is silty clay loam and the B horizon is silty clay or clay.

The C horizon ranges from loam to silty clay loam inclusive. Peds in the A horizon are friable when moist, become hard when dry. Structure of the B horizon ranges from weak fine to medium subangular blocky inclusive.

COMPETING SERIES: These are the Adjuntas, Caguabo, Callabo, Maraguez, Maresua, Morado, Pandura, and Plata series. The Adjuntas are more acid throughout and have lower base saturation. The Caguabo soils have consolidated volcanic rock at 10 to 20 inches. The Callabo soils are drier and have ustic soil moisture regimes. The Maraguez and Morado soils are coarser textured; in addition, the Morado soils have redder colors. The Maresua and Plata soils have profiles with more than 50 percent coarse fragments. In addition, the Plata soils are more acid and have gravelly substrata. The Pandura soils have paralithic contacts within 20 inches.

GEOGRAPHIC SETTING: The Quebrada soils occur in strongly sloping to moderately steep sideslopes of dissected uplands on slope gradients from 12 to 60 percent. The soil formed in deep medium textured residuum weathered from volcanic rock. The climate is humid tropical. The average annual precipitation is 78 inches (200 cm) and the mean annual temperature 76 degrees F.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the competing Maraguez and Morado series in addition to the Caguabo and Mucara series. The Caguabo soils have hard rock within 20 inches and the Mucara soils have paralithic contacts within 20 inches.

DRAINAGE AND PERMEABILITY: Well drained; rapid runoff; moderate permeability.

USE AND VEGETATION: Predominantly native pasture and brush. A

few areas are planted to coffee and other crops.

DISTRIBUTION AND EXTENT: Humid uplands of Puerto Rico. The series is of minor extent.

MLRA OFFICE RESPONSIBLE: Auburn, Alabama

SERIES ESTABLISHED: Ponce Survey Area, Puerto Rico; 1971.

REMARKS: These soils were formerly classified in the Lithosol great soil group.

National Cooperative Soil Survey
U.S.A.

LOCATION REILLY PR

Established Series
Rev. JLL/GRB
08/1999

REILLY SERIES

The Reilly series consists of very deep, excessively drained, rapid permeable soils on flood plains adjacent to streams. They formed in stratified sediments of gravel and sand. Near the type location, the mean annual temperature is about 78 degrees F., and the mean annual precipitation is about 70 inches. Slopes range from 0 to 2 percent.

TAXONOMIC CLASS: Sandy-skeletal, mixed, isohyperthermic Mollic Udifluvents

TYPICAL PEDON: Reilly gravelly loam - sugarcane. (Colors are for moist soil.)

Ap--0 to 9 inches; dark brown (10YR 3/3) gravelly silt loam; weak fine granular structure; friable; slightly sticky, nonplastic; many fine roots; moderately acid; abrupt smooth boundary. (7 to 16 inches thick)

C1--9 to 16 inches; dark grayish brown (10YR 4/2) very gravelly sand; massive; very friable; few fine roots; moderately acid, about 60 percent, by volume, pebbles; few thin silty and clayey layers; abrupt smooth boundary.

C2--16 to 48 inches; clean, coarse sand and gravel; about 70 percent, by volume, coarse gravel, 2 to 3 inches in diameter.

TYPE LOCATION: Suroeste SCD, San German Municipality, Puerto Rico. Approximately 1.0 miles northwest of the city of San German; from the intersection of P.R. Hwy. 102 and P.R. Hwy 347, about 490 feet north of P.R. Hwy. 347 on farm road, about 165 feet west of road in sugarcane field. San German topographic quadrangle; lat. 18 degrees 05 minutes 52 seconds N.; long. 67 degrees 02 minutes 43 seconds W.; PRD 1940.

RANGE IN CHARACTERISTICS: Thickness of the A horizon and depth to the sand and gravel ranges from 7 to 16 inches. Reaction ranges from very strongly acid to slightly acid throughout.

The A horizon has hue of 10YR, value of 2 or 3, and chroma of 2 and 3. Texture is loam, silt loam, or their gravelly analogs. Content of pebbles ranges from 25 to 35 percent, by volume.

The C horizon has hue of 10YR, value of 3 or 4, and value of 3 to 6. Texture is very gravelly sand or extremely gravelly sand. Content of pebbles ranges from 50 to 75 percent, by volume.

COMPETING SERIES: There are no other known series in the same family.

GEOGRAPHIC SETTING: The Reilly soils are on flood plains adjacent to streams. They formed in medium and moderately coarse-textured sediments stratified with gravel and sands in dominant proportions. Slope range from 0 to 2 percent. The climate is humid tropical. The average annual temperature ranges from 76 to 80 degrees F., and the average annual rainfall ranges from 65 to 75 inches.

GEOGRAPHICALLY ASSOCIATED SOILS: These include the Bajura, Coloso, Dique, and Toa series. All of these soils are in flood plains. The poorly drained Bajura soils have more clay in the substratum. The somewhat poorly drained Coloso soils have more clay in the subsoil. The well drained Dique soils have more clay in the subsoil. The well drained Toa soils have more clay in the control section and have Mollic epipedons.

DRAINAGE AND PERMEABILITY: Excessively drained; rapid permeability.

USE AND VEGETATION: Most areas of Reilly soils are in pasture. A few small acreage are in vegetable crops or sugarcane. Vegetation consists of native and introduced species.

DISTRIBUTION AND EXTENT: Humid river flood plains of Puerto Rico. The series is of minor extent.

MLRA OFFICE RESPONSIBLE: Auburn, Alabama.

SERIES ESTABLISHED: Humacao Soil Survey Area, Puerto Rico; 1968.

MLRA: 272.

National Cooperative Soil Survey
U.S.A.

LOCATION SAN ANTON PR

Established Series
Rev. GRB
06/2002

SAN ANTON SERIES

The San Anton series consists of very deep, well drained, moderately permeable soils on alluvial fans and flood plains. They formed in alluvium that weathered from volcanic rock and limestone. Near the type location, the mean annual temperature about 79 degrees F., and the mean annual precipitation about 37 inches. Slopes range from 0 to 12 percent.

TAXONOMIC CLASS: Fine-loamy, mixed, superactive, isohyperthermic Cumulic Haplustolls

TYPICAL PEDON: San Anton clay loam--cultivated. (Colors are for moist soil unless otherwise stated.)

Ap--0 to 9 inches; very dark brown (10YR 2/2) clay loam; weak fine granular structure; friable; slightly sticky, slightly plastic; many fine roots; many fine pebbles of volcanic rock; moderately alkaline; abrupt smooth boundary.

A1--9 to 22 inches; very dark brown (10YR 2/2) clay loam; weak fine subangular blocky structure; friable; slightly sticky, slightly plastic; common fine roots; many fine pebbles of volcanic rock; neutral; abrupt smooth boundary.

A2--22 to 27 inches; dark brown (10YR 3/3) loam; weak fine subangular blocky structure; friable; slightly sticky, slightly plastic, few fine roots; neutral; clear wavy boundary. (Combined thickness of the A and Ap horizons ranges from 22 to 32 inches)

Bw--27 to 34 inches; dark yellowish brown (10YR 4/4) silty clay loam; weak fine subangular blocky structure; friable; slightly sticky, slightly plastic; few fine roots; neutral; clear wavy boundary. (6 to 10 inches thick)

C1--34 to 40 inches; dark yellowish brown (10YR 4/4) silt loam; massive; friable; slightly sticky, slightly plastic; neutral;

abrupt smooth boundary.

C2--40 to 46 inches; dark brown (10YR 3/3) loam, massive; friable; slightly sticky, slightly plastic; neutral; abrupt smooth boundary.

C3--46 to 52 inches; dark yellowish brown (10YR 4/4) silt loam; massive; friable; slightly sticky, slightly plastic; slightly alkaline; abrupt smooth boundary.

C4--52 to 60 inches; dark yellowish brown (10YR 4/4) clay loam; massive; friable; slightly sticky, slightly plastic; slightly alkaline.

TYPE LOCATION: Caribe SCD, Puerto Rico. Approximately 30 feet west of kilometer marker 2.35 of Highway No. 506.

RANGE IN CHARACTERISTICS: Solum thickness ranges from 28 to 42 inches. Reaction ranges from neutral to moderately alkaline throughout and is noncalcareous. Rock fragments range from 0 to 25 percent, by volume.

The A horizons have hue of 10YR, value of 2 or 3, and chroma of 2 or 3. Texture is clay loam or silty clay.

The Bw horizon has hue of 10YR, value of 3 or 4, and chroma of 3 or 4. Texture is silt loam, silty clay loam, clay loam, or gravelly clay loam.

The C horizon has hue of 10YR, value of 3 to 5, and chroma of 3 or 4. Texture is loam, silt loam, or clay loam. In some areas the lower part of the underlying material is sand or loamy sand.

COMPETING SERIES: These include the Cortada, Kawaihapai and Pulehue series. Cortada soils are on slightly lower positions and are calcareous throughout. Kawaihapai and Pulehue soils do not have Bw horizons.

GEOGRAPHIC SETTING: San Anton soils are on alluvial fans and flood plains. They formed in alluvium that weathered from volcanic rock and limestone. The climate is tropical semiarid. Slopes range from 0 to 12 percent. The average annual precipitation ranges from 35 to 40 inches and the average annual temperature ranges from 78 to 80

degrees F.

GEOGRAPHICALLY ASSOCIATED SOILS: These include the competing Cortada soils and the Aguirre, Cintrona, Constancia, Fraternidad, Machuelo, Santa Isabel, and Vayas soils. The somewhat poorly drained Aguirre, the moderately well drained Fraternidad, and the moderately well drained Santa Isabel soils are on higher positions, have smectitic clay control sections, and are Vertisols. The very poorly drained Cintrona soils are on lower positions and have clayey control sections. The somewhat poorly drained Constancia soils are on lower positions and have clayey subsoils. The poorly drained Machuelo and Vayas soils are on lower positions, and have clayey control sections. In addition, Machuelo soils do not have Bw horizons.

DRAINAGE AND PERMEABILITY: Well drained; moderate permeability.

USE AND VEGETATION: San Anton soils are used for pasture and for growing sugar cane, plantains, and truck crops. Vegetation is dominated by guineagrass, buffelgrass, stargrass, pangolagrass, and other native and introduced species.

DISTRIBUTION AND EXTENT: Semiarid areas of southern Puerto Rico. The soils are of moderate extent.

MLRA OFFICE RESPONSIBLE: Auburn, Alabama.

SERIES ESTABLISHED: Puerto Rico, 1936.

REMARKS: The San Anton soil has occasional flooding.

Diagnostic horizons and features recognized in this pedon are:

Mollic epipedon - zone from 0 to 27 inches (Ap, A1, and A2 horizons)

Cambic horizon - zone from 27 to 34 inches (Bw horizon)

National Cooperative Soil Survey
U.S.A.

LOCATION SERRANO PR

Established Series
Rev. CLS
06/2002

SERRANO SERIES

The Serrano series consists of very deep, poorly drained, rapidly permeable soils. They formed in moderately fine over coarse textured sediments. These nearly level soils are on flats in coastal plains. Slopes range from 0 to 2 percent.

TAXONOMIC CLASS: Fine-loamy over sandy or sandy-skeletal, mixed, superactive, nonacid, isohyperthermic Typic Endoaquepts

TYPICAL PEDON: Serrano sand -- weeds. (Colors are for moist soil unless stated otherwise.)

A1-- 0 to 4 inches; very dark grayish brown (2.5Y 3/2) sand; few fine faint dark grayish brown (10YR 4/2) mottles; single grain; loose; nonsticky, nonplastic; many fine roots; violent effervescence; very strongly alkaline; clear smooth boundary. (3 to 6 inches thick).

A2-- 4 to 9 inches; very dark grayish brown (2.5Y 3/2) sandy loam; common fine faint dark grayish brown (10YR 4/2) and many fine distinct black (N 2/) mottles; single grain; loose; nonsticky, nonplastic; common fine roots; 10 percent coarse fragments; violent effervescence; very strongly alkaline; clear smooth boundary. (4 to 6 inches).

Bg-- 9 to 14 inches; dark grayish brown (10YR 4/2) dark greenish gray (5GY 4/1) and brown (10YR 4/3) sandy clay loam; weak fine subangular blocky structure; firm, slightly sticky, plastic; 10 percent coarse fragments; violent effervescence; very strongly alkaline; clear smooth boundary. (4 to 8 inches thick).

C1--14 to 21 inches; very dark grayish brown (2.5Y 3/2) loamy sand; many medium distinct brown (10YR 4/3) and many fine distinct very dark gray (5Y 3/1) mottles; single grain; loose, nonsticky, nonplastic; 10 percent coarse fragments;

violent effervescence; very strongly alkaline; clear smooth boundary. (5 to 10 inches thick).

C2-- 21 to 50 inches; very dark gray (5Y 3/1) sand; few fine faint dark olive gray (5Y 3/2) mottles; single grain; loose, nonsticky, nonplastic; 10 percent coarse fragments; violent effervescence, strongly alkaline.

TYPE LOCATION: Caribe SCD, Puerto Rico; 2.25 miles south of kilometer marker 123.75 of highway 1.

RANGE IN CHARACTERISTICS: Thickness of the solum ranges from 11 to 20 inches. Amount of fine volcanic fragments ranges from 5 to 15 percent.

The A horizon has hue of 2.5Y or 10YR, and chroma of 2 or 3.

The B horizon has hue of 5G, 5Y, 2.5Y and 10YR, value of 3 or 4, and chroma of 1 or higher. Effervescence ranges from violent to strong throughout the profile.

COMPETING SERIES: There are no other series in this family.

GEOGRAPHIC SETTING: The Serrano soils are on coastal plains with slope gradients of 0 to 2 percent. The regolith consists of moderately fine over coarse textured sediments. The climate is semiarid. The average annual precipitation ranges from 20 to 30 inches and the mean annual temperature is 78 degrees F.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Fe and Teresa series, all of which are finer textured and better drained. The Teresa soils have pressure faces and slickensides in the C horizons.

DRAINAGE AND PERMEABILITY: Poorly drained; slow runoff; rapid permeability.

USE AND VEGETATION: Most of the acreage is in salt tolerant weed or is barren land.

DISTRIBUTION AND EXTENT: Semiarid coastal plains of Puerto Rico. The series is of minor extent.

MLRA OFFICE RESPONSIBLE: Auburn, Alabama

SERIES ESTABLISHED: Puerto Rico; 1936.

OCHRIC EPIPEDON: A1 and A2 horizons.

National Cooperative Soil Survey
U.S.A.

LOCATION TERESA PR

Established Series
Rev. LRR/GRB
06/2002

TERESA SERIES

The Teresa series consists of very deep, somewhat poorly drained, very slowly permeable soils on alluvial flats in valley floors of the Semiarid Coastal Plain MLRA. They formed in clayey marine sediments. Near the type location, the mean annual temperature is about 79 degrees F., and the mean annual precipitation is about 35 inches. These soils are saline. Slopes range from 0 to 1 percent.

TAXONOMIC CLASS: Very-fine, smectitic, isohyperthermic Sodic Haplusterts

TYPICAL PEDON: Teresa clay - pasture. (Colors are for moist soil.)

Ap--0 to 10 inches; very dark gray (10YR 3/1) clay; moderate medium subangular blocky structure; hard, firm; very sticky, very plastic; many very fine and fine roots; many very fine interstitial pores; neutral; clear wavy boundary. (4 to 12 inches thick)

Bss1--10 to 26 inches; very dark gray (10YR 3/1) clay; strong coarse prismatic structure; very hard, very firm; very sticky, very plastic; many very fine and fine roots; few medium tubular and vesicular pores; many large slickensides having distinct polished and grooved surfaces; few distinct soft masses of iron-manganese; slightly alkaline; gradual wavy boundary.

Bss2--26 to 38 inches; very dark grayish brown (10YR 3/2) clay; strong coarse prismatic structure; very hard, very firm; very sticky, very plastic; common very fine and fine roots; many very fine, common fine, and few medium tubular and vesicular pores; many large slickensides having distinct polished and grooved surfaces; few distinct soft masses of iron-manganese; few fine prominent yellowish brown (10YR 5/8) masses of iron accumulation on faces of peds and

slickensides; slightly alkaline; clear smooth boundary. (Combined thickness of the Bss horizons ranges from 10 to 40 inches)

Bssz--38 to 44 inches; very dark grayish brown (10YR 3/2) clay; weak coarse prismatic structure; very hard, very firm; very sticky, very plastic; few very fine and fine roots; many very fine, common fine, and few medium tubular and vesicular pores; common large slickensides having distinct polished and grooved surfaces; few distinct soft masses of calcium carbonate; few distinct salt crystals; few distinct soft masses of iron-manganese; few medium prominent yellowish brown (10YR 5/8) masses of iron accumulations on faces of peds and slickensides; slightly alkaline; clear smooth boundary. (8 to 12 inches thick)

Bsszg1--44 to 62 inches; dark brown (10YR 3/3) clay; weak medium subangular blocky structure; very hard, very firm; very sticky, very plastic; few very fine and fine roots; many very fine, common fine, and few medium tubular and vesicular pores; common large slickensides having distinct polished and grooved surfaces; common distinct salt crystals; few distinct soft masses of iron-manganese; common medium distinct olive brown (2.5Y 4/4) masses of iron accumulation; slightly alkaline; gradual wavy boundary.

Bsszg2--62 to 78 inches; brown (10YR 4/3) clay; weak medium subangular blocky structure; very hard, very firm; very sticky, very plastic; few very fine, fine, and medium roots; many very fine, common fine, and few medium tubular and vesicular pores; many large slickensides having distinct polished and grooved surfaces; many distinct salt crystals; many distinct soft masses of iron-manganese; common medium prominent dark gray (2.5Y 4/1) areas of iron depletions; few medium prominent yellowish brown (10YR 5/8) masses of iron accumulation; slightly alkaline; clear wavy boundary. (Combined thickness of the Bsszg horizons ranges from 5 to 8 inches)

Bzg--78 to 85 inches; dark gray (2.5Y 4/1) clay; weak medium subangular blocky structure; very hard, very firm; very sticky, very plastic; few very fine and fine roots; many very fine, common fine, and few medium tubular and vesicular pores; few faint salt crystals; common distinct soft masses of iron-manganese; common prominent yellowish brown (10YR 5/6) masses of iron accumulation; slightly alkaline.

TYPE LOCATION: Cabo Rojo Municipio, Puerto Rico. Approximately 5.4 miles south of Cabo Rojo and about 1.1 miles south of Las Arenas on P.R. Hwy. 301 from the intersection of P.R. Hwy. 101, and about 0.2 miles east in pasture. Puerto Real topographic quadrangle; lat. 18 degrees 0 minutes 33 seconds N.; long. 67 degrees 8 minutes 49 seconds

W.; PRD 1940.

RANGE IN CHARACTERISTICS: Solum thickness is more than 80 inches. Reaction is neutral to strongly alkaline in the A or Ap horizon, and slightly alkaline to strongly alkaline in the rest of the profile.

The A or Ap horizon has hue of 10YR, value of 3 or 4, and chroma of 1 to 3.

The Bss horizons have hue of 10YR, value of 3 or 4, and chroma of 1 to 3. Iron accumulations in shades of brown and yellow range from few to many and are most common on surfaces of peds or slickensides and generally increasing with depth. Soft masses of iron-manganese range from few to many.

The Bssz horizons have hue of 10YR, value of 3 or 4, and chroma of 1 to 3. Iron accumulations in shades of brown range from few to many and are most common on surfaces of peds or slickensides and generally increasing with depth. Some pedons have no dominant color and are multicolored in shades of brown and yellow. Small faint salt crystals range from few to many. Soft masses of calcium carbonate range from none to common. Soft masses of iron-manganese range from few to many.

The Bsszg horizons have hue of 10YR or 2.5Y, value of 3 to 5, and chroma of 1 or 2. Iron accumulations in shades of brown range from few to many and are most common on surfaces of peds or slickensides. Small faint salt crystals range from few to many. Soft masses of iron-manganese range from few to many.

The Bzg horizons have hue of 10YR or 2.5Y, value of 3 to 5, and chroma of 1 or 2. Iron accumulations in shade of brown range from few to many and are most common on surfaces of peds or slickensides. Small faint salt crystals range from few to many. Soft masses of iron-manganese range from few to many.

COMPETING SERIES: There are no competing series in this family.

GEOGRAPHIC SETTING: Teresa soils are on nearly level valley floors of the Semiarid Coastal Plains MLRA. Slopes range from 0 to 1 percent. They formed in clayey marine sediments. The climate is semiarid tropical. The mean annual temperature ranges from 78 to 80 degrees F., and the average annual precipitation ranges from 30 to 40 inches.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Boqueron, Cartagena, Fe, and Fraternidad soils. Boqueron soils are on lower adjacent tidal areas dominated by mangrove trees and have mixed, fine-silty control sections. Cartagena soils are on slightly higher positions, have a clay content ranging from 35 to 60 percent, and have mixed mineralogy. Fe and Fraternidad soils are on slightly higher positions and have a clay content ranging from 35 to 60 percent.

DRAINAGE AND PERMEABILITY: Somewhat poorly drained; very slow permeability.

USE AND VEGETATION: Most areas of Teresa soils are used for pastureland. The vegetation consists of lippia, mesquite, desmanthus, and other xerophytic and salt-tolerant plants.

DISTRIBUTION AND EXTENT: Semiarid coastal plains of Puerto Rico. The series is of minor extent.

MLRA OFFICE RESPONSIBLE: Auburn, Alabama

SERIES ESTABLISHED: Puerto Rico; 1936.

REMARKS: These soils were formerly classified in the Solonetz great soil group.

Diagnostic horizons and feature recognized in this pedon are:

Ochric horizon - 0 to 10 inches (Ap horizon).

Cambic horizon - the zone from about 13 to 80 inches (Bss, Bssz, Bsszg, and Bzg horizons).

Intersecting slickensides beginning about 28 inches and continuing to a depth of about 78 inches (Bss, Bssz, and Bsszg horizons).

The type location was moved to its present location in 1998 and the series reclassified based on soil lab data and observations in the field.

ADDITIONAL DATA: Characterization pedon - Cabo Rojo Municipio, Puerto Rico; S97PR--023-001 sample by SSL, Lincoln, NE. 6/97.

MLRA: 273.

National Cooperative Soil Survey
U.S.A.

LOCATION TUQUE PR

Established Series
Rev. REG
06/2002

TUQUE SERIES

The Tuque series have a thin, granular, reddish, fine textured, calcareous gravelly A horizon and lighter colored, finer textured, calcareous, gravelly weakly developed B horizon over a petrocalcic horizon.

TAXONOMIC CLASS: Clayey-skeletal, carbonatic, isohyperthermic Lithic Petrocalcic Calciustolls

TYPICAL PEDON: Tuque gravelly clay - brushy pasture.
(Colors are for moist soils unless otherwise stated.)

0--1 to 0 inches; consists of partially decomposed organic litter, leaves and twigs.

A1--0 to 5 inches; dark reddish brown (2.5YR 3/4) gravelly clay; weak fine granular structure; friable, slightly sticky, plastic; many fine and medium roots; strong effervescence; many shell fragments; clear broken boundary. (4 to 6 inches thick)

B2--5 to 11 inches; dark red (2.5YR 3/6) gravelly clay; weak fine and medium subangular blocky structure breaking to weak fine granular structure; firm, slightly sticky, plastic; violent effervescence; clear broken boundary. (4 to 8 inches thick)

C1cam--11 to 19 inches; very pale brown (10YR 8/3) caliche indurated, laminar containing brownish horizontal bands; gradual broken boundary. (4 to 8 inches thick)

C2--19 to 24 inches; strong brown (7.5YR 5/6) gravelly clay; massive; firm, slightly sticky, plastic, violent effervescence;

gradual wavy boundary. (4 to 8 inches thick)

C3--24 to 60 inches; consists of gravelly limestone that can be penetrated with the spade or auger.

TYPE LOCATION: Sur SCD, Puerto Rico; 500 meters north of kilometer marker 254.8 of Highway No. 1.

RANGE IN CHARACTERISTICS: Thickness of the solum and depth to the petrocalcic horizon range from 8 to 14 inches. Thickness of the petrocalcic horizon varies from 4 to 8 inches. Depth to the gravelly limestone ranges from 16 to 30 inches. Percent of limestone fragments throughout the profile ranges from 35 to 50 percent. Amount of rocks in the surface ranges from 35 to 45 percent.

The A horizon has hues of 2.5 YR or 5YR, values of 3 and chromas of 3 or 4.

The B horizon has colors in hues of 2.5YR, values of 3 and chromas of 4 or 6. Texture of the solum is dominantly gravelly clay. Structure of the B horizon ranges from weak fine and medium subangular blocky to moderate fine granular inclusive.

Effervescence with 10 percent hydrochloric acid is strong or violent. The mean annual soil temperature ranges from 78 to 80 degrees F.

COMPETING SERIES: These include the Cho, Hesselberg, and Mereta soils of the same subgroup in addition to the Aguilita soils. The Cho and Mereta soils are not skeletal and have thermic soil temperature. The Hesselberg soils lack the gravel above the petrocalcic horizon and the Aguilita soils lack the petrocalcic horizon.

GEOGRAPHIC SETTING: The Tuque soils occur on moderately sloping to steep hills with slope gradients of 12 to 60 percent. The soil formed in fine textured residuum over gravelly partially indurated limestone. The climate is semiarid. The average annual precipitation ranges from 20 to 30 inches (50-75cm) and the mean annual temperature is 78 degrees F.

GEOGRAPHICALLY ASSOCIATED SOILS: These are Yauco and the competing Aguilita soils. The Yauco series lacks a petrocalcic horizon.

DRAINAGE AND PERMEABILITY: Well drained; runoff is medium, rapid permeability.

USE AND VEGETATION: Most of the acreage is in low brush.

DISTRIBUTION AND EXTENT: Semiarid uplands of southern Puerto Rico. The series is of moderate extent.

MLRA OFFICE RESPONSIBLE: Auburn, Alabama

SERIES ESTABLISHED: Ponce Survey Area, Puerto Rico; 1971.

REMARKS: These soils were formerly classified in the Lithosol great soil group.

National Cooperative Soil Survey
U.S.A.

LOCATION YAUCO PR

Established Series
Rev. GRB
06/2002

YAUCO SERIES

The Yauco series consists of moderately deep, well drained, moderately permeable soils on rounded hills and foot slopes of uplands. They formed in calcareous sediments overlying soft limestone bedrock. Near the type location, the mean annual temperature is about 79 degrees F., and the mean annual rainfall is about 25 inches. Slopes range from 2 to 12 percent.

TAXONOMIC CLASS: Fine-silty, carbonatic, isohyperthermic Typic Calciustolls

TYPICAL PEDON: Yauco silty clay loam - rangeland. (Colors are for moist soil unless otherwise stated.)

Ap--0 to 11 inches; very dark grayish brown (10YR 3/2) silty clay loam; strong fine and medium granular structure; firm; slightly sticky, plastic; many fine roots; common fine shell, volcanic and limestone fragments; strongly effervescent; moderately alkaline; clear smooth boundary. (8 to 14 inches thick)

Bk1--11 to 17 inches; dark brown (10YR 4/3) silty clay loam; moderate fine and medium subangular blocky structure; firm; slightly sticky, plastic; few fine roots; common fine shell fragments; many fine accumulations of calcium carbonate in form of filaments and pendents; violently effervescent; moderately alkaline; clear smooth boundary.

Bk2--17 to 21 inches; about 50 percent yellowish brown (10YR 5/4) and about 50 percent light yellowish brown (10YR 6/4) silty clay loam; weak fine subangular blocky structure; firm; slightly sticky, plastic; many CaCO3 accumulations in form of filaments and pendents; violently effervescent; moderately alkaline; clear wavy boundary. (Combined thickness of the Bk horizons range from 12 to 22 inches)

Cr--21 to 60 inches; soft limestone that can be easily penetrated with a spade or auger.

TYPE LOCATION: Caribe SCD, Puerto Rico. Approximately 1.5 miles west of kilometer marker 3.05 on Highway 510.

RANGE IN CHARACTERISTICS: Solum thickness and depth to the soft limestone ranges from 20 to 40 inches. Reaction is moderately alkaline throughout. Amount of fine limestone fragments in the solum ranges from few to common, but never exceeds 15 percent by volume.

The A horizon has hue of 10YR, value of 2 or 3, and chroma of 3 or less. Texture is loam or silty clay loam.

The Bk horizon has hue of 10YR, value of 3 to 6, and chroma of 2 to 4; or there is no dominant color and is multicolored in shades of yellow and brown. Texture is dominantly silty clay loam.

The C horizon, where present, has hue of 10YR, value of 6 to 8, and value of 1 to 4. Texture is loam, silt loam, clay loam, or silty clay loam; or their channery or cobbly analogues. Percent by volume of soft chalk fragments ranges from 5 to 15 percent. Content of nodules, concretions, and/or soft masses of calcium carbonate ranges from common to many.

The Cr horizon is level-bedded chalk or soft limestone with platy rock structure. It can be easily excavated with hand tools, and is rippable by mechanized equipment.

COMPETING SERIES: There are no known series in the same family.

GEOGRAPHIC SETTING: Yauco soils are on rounded hills and foot slopes. They formed in calcareous sediments overlying soft limestone bedrock. The climate is tropical semiarid. Slopes range from 2 to 12 percent. The average annual temperature ranges from 78 to 80 degrees F., and the average annual rainfall ranges from 20 to 30 inches.

GEOGRAPHICALLY ASSOCIATED SOILS: These include the Aguilita and Tuque soils. These soils are on higher positions in the landscape. In addition, Aguilita soils are deep to soft limestone and have coarse-loamy subsoils while Tuque soils are shallow to a petrocalcic horizons and are clayey skeletal.

DRAINAGE AND PERMEABILITY: Well drained; moderate permeability.

USE AND VEGETATION: Yauco soils used for both pasture and crop production. Vegetation chiefly in Guinea grass and cultivated areas are used for production of sugarcane.

DISTRIBUTION AND EXTENT: Semiarid areas of southern Puerto Rico. The series is of moderate extent.

MLRA OFFICE RESPONSIBLE: Auburn, Alabama.

SERIES ESTABLISHED: Puerto Rico; 1936.

REMARKS: Diagnostic horizons and features recognized in this pedon:

Mollic epipedon - the zone from 0 to 11 inches (Ap horizon).

Calcic horizon - the zone from 11 to 21 inches (Bk horizons).

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